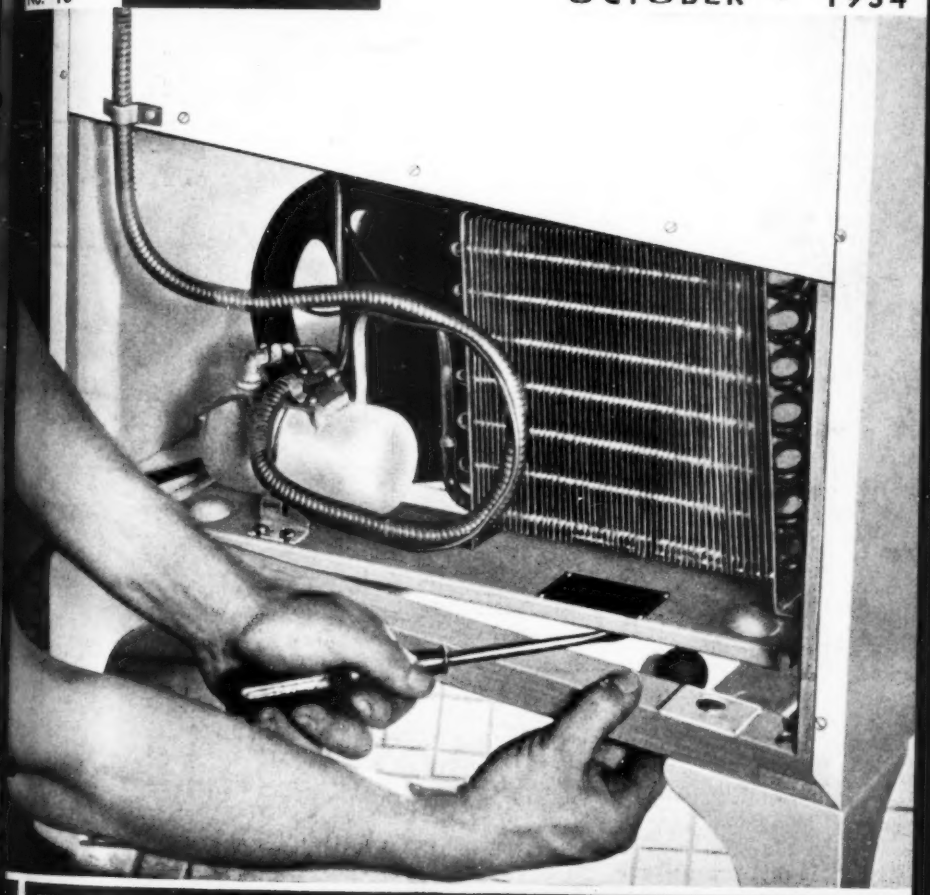
The Refrigeration Service Engineer

Vol. 2
No. 10

OCTOBER • 1934



The Norge Rollator Compressor — Motor Servicing — Controlling Refrigerants — Water Cooling Systems — Diagrams

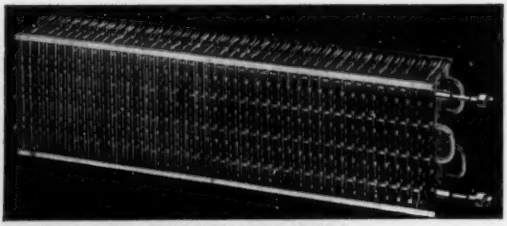
How to Safeguard Your Reputation

by using

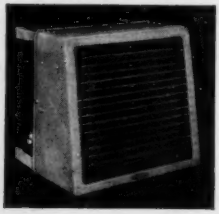
FEDDERS

Standard Approved REFRIGERATION APPLIANCES

The equipment you use should be as good as your workmanship. Service and Installation Engineers are safeguarding their reputation and profits by using Fedders Standard Approved Refrigeration Appliances. Fedders complete line gives you the correct answer to every job. Write for useful Data Book No. 75 giving complete specifications, dimensions, capacities and installation data.



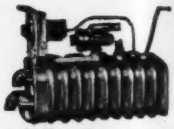
FEDDERS NON-FROST EVAPORATORS
With Copper Fins Fused to Copper Tubes



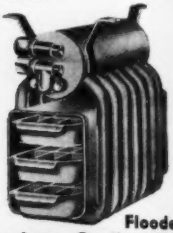
Made in a thousand sizes with flat or fluted fins. Flat Fin models as shallow as 1¼" high. Made for all refrigerants including Ammonia. Write for Bulletin 40-B.

FEDDERS FORCEDRAFT UNIT HEATERS

Have exclusive water troughs which maintain correct relative humidity. Made in 8 sizes from 1/10 to 1½ tons IME.



Prestalloy Evaporators
Made in 2, 3 and 4 tray sizes. Beautiful appearance makes shields unnecessary.



Flooded Tube-type Cooling Units
All sizes from 2 to 16 trays. For all refrigerants except ammonia.

Cutaway view of interior
Pats. Pending

Fedders Thermostatic Expansion Valve
Built to please Installation Engineers! Easy, sensitive adjustment . . . interchangeable power element bellows and tube assembly . . . hermetically sealed housing.

Are You Getting Your Copy of the FEDDERS NEWS?

FEDDERS MANUFACTURING CO.

57 TONAWANDA ST., BUFFALO, N. Y.

300 4th Avenue, New York City
222 E. Ninth St., Cincinnati
209 S. Pearl St., Dallas
603 W. Washington Blvd., Chicago
923 E. Third St., Los Angeles

WHEN YOU BUY FEDDERS YOU BUY THE BEST

The REFRIGERATION SERVICE ENGINEER

Devoted to the Servicing of
REFRIGERATION UNITS *and* OIL BURNERS

VOL. 2 OCTOBER, 1934 NO. 10

Table of Contents

The Norge Rollator Refrigerator 3

Diagnosis of Motor Troubles, by *Geo. C. Tatem* 14

Water Cooling System, by *John Ellison* 15

Diagram of Water Cooling System 16

Control of Refrigerants, by *J. L. Shrode* 20

Building "Off Peak" Servicing 23

New Compressor Design 26

Keep Informed 28

R.S.E.S. News 29

PUBLISHED MONTHLY BY

NICKERSON & COLLINS COMPANY

433-435 NORTH WALLER AVE., CHICAGO, ILL.

EASTERN OFFICE: 149 BROADWAY, NEW YORK CITY

Publishers for 42 years of Technical Books and Trade Journals Serving the Refrigeration Industries.
Subscription: United States $2.00 per year. Single copies 25c. All other countries $3.00 per year.

Copyright, 1934, by Nickerson & Collins Co., Chicago

Household Refrigeration

FOURTH EDITION
700 PAGES
270 Illustrations

by H. B. Hull

A book every serviceman, salesman, and designer of household refrigerators, should have for ready reference

This New Edition Affords a Thorough and Practical Treatment of - - - - -

Refrigeration Principles, Units and Theory.

Food and Refrigeration—The results of many years of laboratory testing by one of the leading authorities on this subject.

Domestic Refrigerators — Desirable temperatures, air circulation, humidity tests.

Refrigerants — Complete tables of properties and characteristics, including information concerning the new gases lately introduced by several of the leading manufacturers.

Thermodynamics—The relationships and applications of the science of thermodynamics and physical chemistry to refrigeration. Explanation of various cycles.

Heat Transmission—The fundamental laws regarding the transmission of heat and the application of these laws to refrigerator construction and the design of condensers, evaporators and other heat transfer apparatus.

Absorption Refrigerating Units—Principles and construction of household refrigerating units of the absorption type, including the recent developments in air cooling and use of solid absorbents.

Compression Type Refrigerating Systems—Specific data covering modern practice for designing the various units comprising household refrigerating systems. Detailed descriptions of the principles and operation of the many types of compressors, condensers, valves, controls and accessories as used by manufacturers of this equipment at the present time. Complete descriptions with photographs and construction details of the refrigerating systems, compressors and cabinets of the leading concerns in this industry.

Testing and Code Requirements—The method of testing refrigerators has lately been standardized and code requirements are of increasing importance. This edition contains full information on these subjects.

Air Conditioning—The fundamentals of air conditioning and the application of these principles to the office, residence and commercial establishment. Complete design data concerning unit conditioners.

Commercial Refrigerating Systems—Practical information regarding the use of small refrigerating machines in commercial establishments. The latest methods of cooling cases, counters and cold storage rooms.

NICKERSON & COLLINS COMPANY, PUBLISHERS, 435 N. Waller Avenue, Chicago, Ill.

Please send to the address below, a copy of the Fourth Edition of HOUSEHOLD REFRIGERATION, bound in .....
(Indicate Cloth or Morocco).

☐ Enclosed is remittance. ☐ Send Bill.

Name .....

Address .....

City ..... State .....

CLOTH BINDING $4.00 MOROCCO $5.00

The Refrigeration Service Engineer

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

VOL. 2, NO. 10 CHICAGO, OCTOBER, 1934 $2.00 per Annum

The Norge Rollator Compressor

The Design and Operation of the Norge Rollator. Cycle of Operation and Description of Component Parts

THE Norge compressor, due to its design, is commonly known as the "Rollator." It is of the rotary positive displacement type. Compression is obtained by means of an eccentrically driven roller moving in a gyratory manner in a closed cylinder. The inlet and discharge passages are separated by a blade which maintains contact under oil pressure with the roller surface.

In Fig. 1 is illustrated the Norge cycle of operation.

Oil Circulation

Oil in the system follows the same path as the SO_2, only much slower. A certain amount returns to the "Rollator" with the low pressure gas. It passes into the cylinder and into the discharge port with the compressed gas. At this point most of it drops into the main body of oil in the Rollator, the balance passing into the condenser. Under high pressure this portion mixes with the liquid SO_2 in the condenser to form an approximate 6% solution which in turn passes into the receiver. From the receiver this solution of oil and liquid SO_2 passes into the evaporator. As the liquid evaporates the oil remains behind and since it is lighter than SO_2 rises to the top and floats on the liquid.

In the float ball evaporator oil is carried into the oil return pocket by capillary metal wicks attached and by the suction velocity of the gas being returned and from here is carried down the suction tube to the Rollator.

In bucket float evaporators quantities of oil are carried over into the bucket during the vaporizing or boiling of the SO_2 and from there are carried down the suction tube to the "Rollator."

In the Norge dual evaporator unit, where the low side is built up around a continuous tube without headers, the oil separates from the solution and returns to the compressor, usually at the start of a running cycle.

All moving parts of the Rollator are completely submerged in oil under pressure.

Compressor Design

The Rollator is designed with adequate clearance between the roller and cylinder. The film of oil under the compressor serves as a seal between the surfaces. The roller does not revolve at shaft speed, simply rolling slowly around the eccentric portion of the shaft. The contact between the blade and the roller is a rocking motion, their surfaces matching.

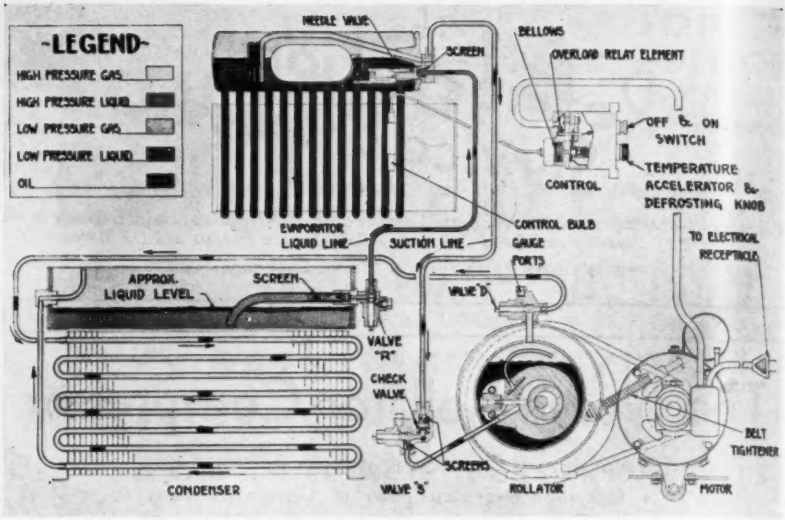


FIG. 1. CYCLE OF OPERATION OF NORGE COMPRESSOR.

The moving parts, are three in number, namely the shaft, the blade and the roller which are submerged in oil under pressure. This affords a film of oil at all times between the moving surfaces reducing wear to a minimum and assuring continued efficiency and quiet operation. All parts are held to an extremely close limit of accuracy and rarely is it necessary to replace them.

The Rollator seal is located on the high side of the system below the oil level so that no gas comes into contact with it. There is no danger of drawing air or moisture into the system through the seal, the pressure being outward at all times.

Fig. 2 is an illustration of the Rollator design and in Fig. 3 the cycle of compression is graphically illustrated.

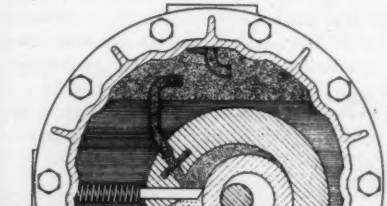


FIG. 2. ROLLATOR DESIGN.

Lubrication

The oil level in the Rollator is just below the top of the discharge tube. Condensing compressors insure forced lubrication to all three moving parts of the Rollator. The counter balance mounted on the eccentric shaft is located in a symmetrical pocket thus performing three operations, namely, counter balancing, forced lubrication and oil cooling. Oil entering the cylinder is forced through the discharge tube. As it leaves the tube its velocity is reduced and consequently most of the oil drops into the main body of oil in the Rollator.

Service Valves

There are three shut-off valves in the Norge system. The valves are double seated and designed so that when turned all the way counter clockwise the plugs in the ports may be removed and gauges attached with-

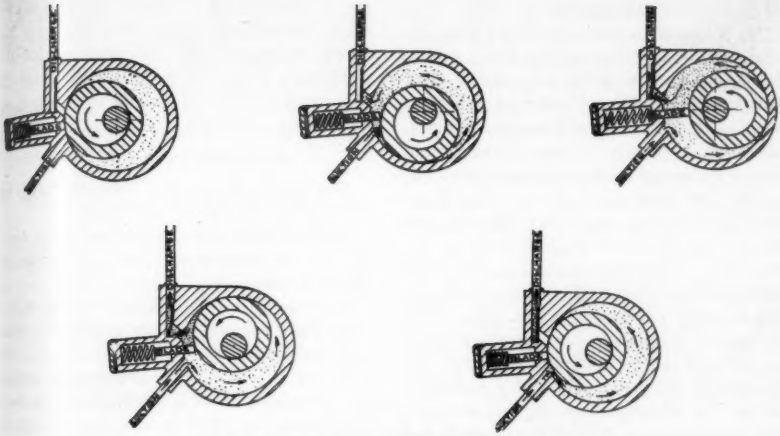


FIG. 3. CYCLE OF COMPRESSION OF NORGE ROLLATOR.

Top Views—Cylinder Full of Gas at Start of Compression—Compression Started and Beginning of Suction Stroke—Discharge and Suction Strokes Half Completed.

Bottom Views—Discharge Valve Open in Compression Stroke—Discharge and Suction Strokes Completed.

out the loss of any refrigerant. When closed all the way clockwise the main openings in the valves are closed. Special ring type packing is used in the valve construction to prevent leaks along the stem and a brass cap is screwed over the end against a fibre gasket.

The discharge shut-off valve is attached to the outlet opening on top of the Rollator. The receiver shut-off valve is in assembly with screen inserted which extends into the bottom of receiver tank insuring constant flow of liquid SO_2 to the evaporator at all times. The suction shut-off valve is attached to the intake opening of the Rollator. The check valve prevents the oil and gas from being forced out of the Rollator back through the suction line into the evaporator when equipment is not operating. The check valve disc is chrome plated and closes against a brass seat. The movement of the disc is very slight and as a result the operation of the valve is quiet.

Electric Circuit

The electric circuit of the Norge system is illustrated in Fig. 4. One side of the incoming line goes directly to the motor while the other passes through the overload cut-out, then through the defrosting switch and cold accelerator before returning to the motor. Thus, if the overload cut-out is tripped or if the cold accelerator switch is open or if the defrosting switch is in the off position the motor will not start.

When the standard 60-cycle motor is replaced by an odd cycle or d.c. motor it will be necessary to make changes in the suspension springs. On the standard 60-cycle unit the front springs are painted blue.

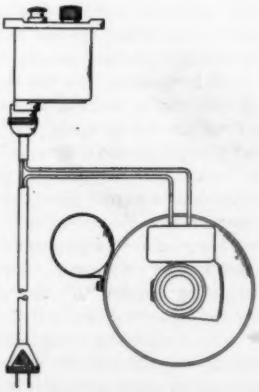


FIG. 4. WIRING CIRCUIT.

Evaporator

The Norge evaporator used on all domestic models except one of the direct expansion type operates on the flooded principle. Model "W" is equipped with a dual evaporator unit. This evaporator is made up of two sections, namely, a sharp freezing section and a finned tube section mounted side by side and connected in series. The sharp freezing section accommodates eight ice cube trays. The fin tube section provides the necessary evaporator cooling surface for cabinet temperatures. The dual evaporator unit is a dry expansion system. The liquid refrigerant is admitted into the sharp freezing section at a predetermined pressure through an automatic adjustable expansion valve. The evaporator tubing passes under and is soldered to the bottom of shelf and continues on passing through fin sections to the suction line. The automatic expansion

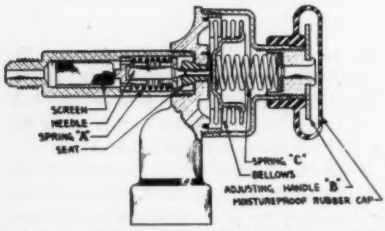


FIG. 5. AUTOMATIC EXPANSION VALVE.

valve on the model "W" dry expansion evaporator is shown in Fig. 5. The operation of this expansion valve is as follows:

The needle is actuated by any movement of the bellows by a plunger passing through the valve seat opening. As the pressure within the bellows is lowered by the Rollator the force exerted by spring "C" causes the bellows plunger to force the needle away from the seat. This allows high pressure liquid refrigerant to enter. The pressure of this refrigerant plus the pressure of spring "A" allows the needle to seat properly shutting off the flow of refrigerant. By means of the adjusting handle "B" the pressure exerted by the adjusting spring "C" may be varied so as to impart the setting desired.

The setting is affected by atmospheric pressure and hence in localities of high altitudes some field adjustment may be necessary. The altitude at which the valves are set is 598 feet above sea level and each increase or decrease of 1000 feet in altitude produces a respective increase or decrease of about one inch of vacuum in the setting of the valve.

Testing Efficiency of Rollator

The efficiency of the Rollator may be checked in the following manner:

The Rollator should be warm when testing, as a cold Rollator is not operating at its greatest efficiency.

a—Install compound gauge in valve "S."

b—Turn valve "S" all the way to the right clockwise.

c—Start Rollator. Compound gauge should read at least 20 inches of vacuum.

Inefficiency may be due to stuck blade, scored roller, broken blade spring, lack of oil in Rollator, leaky discharge valve or discharge tube broken loose at soldered joint. A stuck blade is indicated by a cool Rollator, condenser and receiver, no refrigeration and possibly a clicking noise when the roller passes the blade.

To replace stuck blade, first determine whether the sticking condition has been caused by a foreign particle or blade slot or by corrosion. If blade is corroded, the entire Rollator should be disassembled and thoroughly cleaned.

A broken blade spring gives much the same indication except that there is no pronounced click. The blade will continue to function due to oil pressure keeping in contact with the roller.

Lack of oil in Rollator is indicated by long or continuous running, defrosting of the evaporator and a loud rattling sound in the Rollator.

Shortage of oil in the Rollator may be due to a seal leak, a leaky check valve, a leaky needle valve, or a leaky expansion valve. If the check valve, the needle valve or the expansion valve leaks, the oil will be retained in the system, but will find its way to the evaporator. An oil-logged evaporator will be indicated by improper frosting of the evaporator. This condition, however, should not be confused with improper circulation of air in the cabinet, which might prevent frosting of the rear tubes.

If shortage is due to seal leak, the seal must be replaced and sufficient oil added.

Under no circumstances should oil be added to the system until it is definitely determined that the shortage is due to a leak; if a surplus is in the evaporator it must be returned to the Rollator.

Removing Oil from Evaporator

It is possible for too much of the oil charge to get into the evaporator through a leaky check valve, through a leaky needle valve or through a leaky expansion valve.

This condition will cause an inefficient Rollator, and also will reduce the efficiency of the evaporator.

NOTE: The following procedure applies to flooded evaporators with the open pan type float.

When it has been definitely determined that part of the oil charge is in the evaporator, stop motor, close valve clockwise against the front seat, remove shield, loosen the two front evaporator hanger bolt nuts, remove the rear hanger bolt nut and tip the evaporator backwards. This permits the float pan to be filled with liquid, thereby opening the needle valve and flooding the evaporator with refrigerant. It may be necessary to remove the top throat lining to permit bending of the connecting tubing. Permit liquid to fill up the evaporator until the hissing sound at the needle valve stops. Tilt evaporator down toward front and then return to a level position. Start motor, crack valve slightly and throttle the admission of liquid to the Rollator, keeping the suction pressure as indicated by the compound gauge, below zero pound.

If a loud knocking noise is heard in the Rollator, close valve temporarily.

As the Rollator gradually empties the float pan, valve can be opened slowly until the system is operating normally. Allow system to run about ten minutes and test the efficiency of the Rollator. If Rollator is still inefficient, repeat the above procedure and again test efficiency. It is seldom necessary to flood the evaporator more than twice.

It is sometimes possible to return oil to Rollator by filling ice trays with boiling water and allowing the unit to operate. The heat causes a violent agitation of the refrigerant and a foaming of the oil over into the float pan. From here it is drawn back to the Rollator through the suction line.

NOTE: *If throat lining has been removed, be sure to reseal the tubing channel with Sealing Compound.*

Adding Oil to System

When it has been definitely determined that the system is short of oil, proceed to add oil as follows:

Stop motor, connect a short length of ¼" tubing to valve with a globe valve between the tubing and valve. Close globe valve tightly and close valve clockwise. Pour ¼ pint of *clean, dry oil* in a clean, dry bottle. After cracking valve to purge air out of tubing, immerse tubing in oil.

Start motor and allow Rollator to draw oil slowly from bottle. When Rollator becomes quiet, close globe valve and test efficiency of Rollator. Continue to add oil, in small quantities, until Rollator operates with normal sound and efficiency. *Do not overload system with oil.*

CAUTION: *Be sure end of tubing is kept submerged below the oil level in bottle so that air will not be drawn into system.*

Discharging Rollator Only

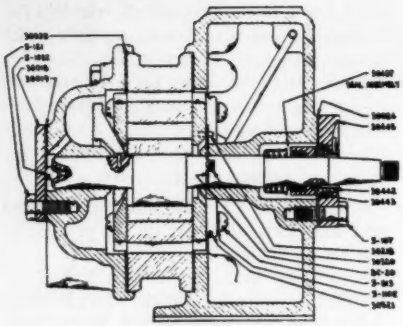
To discharge Rollator only, install compound gauge in valve. Turn valve all the way to right. Turn valve all the way to left. Remove pipe plug; install ⅛" pipe by ¼" flare union. Attach globe valve with purging tubing.

Extend tubing into solution of thirteen ounces of lye to one and one-half gallons of water. When discharging into lye solution place tube at bottom of container.

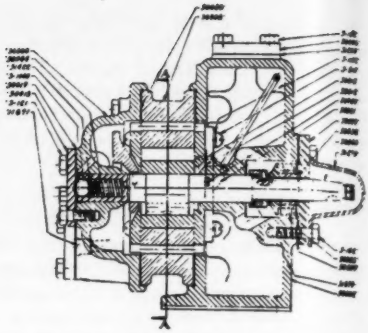
Make sure globe valve is closed by turning all the way to the right. Close valve.

Crack globe valve and allow Rollator to discharge slowly. A little heat carefully applied to the Rollator will hasten the process. The Rollator must not be overheated. No part should be so hot that the *hand* cannot be held upon.

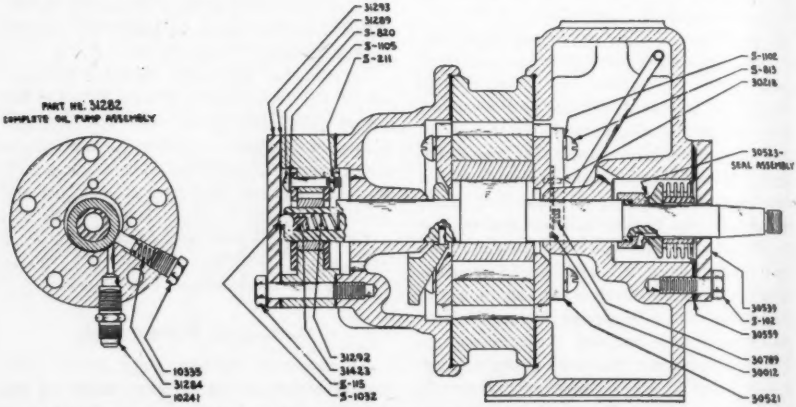
CAUTION: *Do not leave Rollator* while discharging into lye solution as the process will reverse itself when the gas is completely exhausted, and will *draw the lye water* back into Rollator, damaging it beyond repair.



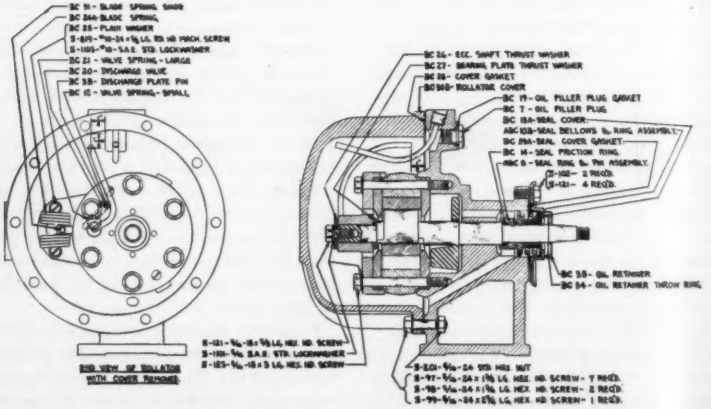
ROLLATOR USED ON 1930 MODELS.



ROLLATOR USED ON 1931-32 MODELS.



ROLLATOR USED ON MODEL H AND W REFRIGERATOR'S EQUIPPED WITH OIL PUMPS.


BC 11 - BLADE SPRING, SMALL
BC 24A- BLADE SPRING,
BC 25 - PLAIN WASHER
S-1105-10-SAE STD. LOCKWASHER
BC 23 - VALVE SPRING - LARGE
BC 20 - DISCHARGE VALVE
BC 38 - DISCHARGE PLATE PIN
BC 12 - VALVE SPRING - SMALL
END VIEW OF ROLLATOR WITH COVER REMOVED
BC 26 - ECC. SHAFT THRUST WASHER
BC 27 - BEARING PLATE THRUST WASHER
BC 28 - COVER GASKET
BC 24B- ROLLATOR COVER
BC 19 - OIL FILLER PLUG GASKET
BC 7 - OIL FILLER PLUG
BC 18A-SEAL COVER
ABC 10B-SEAL BELLOWS & RING ASSEMBLY
BC 29A-SEAL COVER GASKET
BC 14 - SEAL FRICTION RING
ABC 8 - SEAL RING & PIN ASSEMBLY
S-102 - 2 REQ'D.
S-121 - 4 REQ'D.
BC 35 - OIL RETAINER
BC 34 - OIL RETAINER THROW RING
S-121 - 1/4-18 x 1/2 LG. HEX. HD. SCREW
S-1105- 1/4 S.A.E. STD. LOCKWASHER
S-123- 1/4-18 x 3 LG. HEX. HD. SCREW
S-120- 1/4-24 STD. HEX. NUT
S-97- 1/4-24 x 1/2 LG. HEX. HD. SCREW - 7 REQ'D.
S-98- 1/4-24 x 1 1/2 LG. HEX. HD. SCREW - 2 REQ'D.
S-99- 1/4-24 x 2 1/2 LG. HEX. HD. SCREW - 1 REQ'D.

ROLLATOR USED ON 1934 MODELS.

General Information on Norge 1930-31-32 Units

Model	No.	Finish		Net Cab. Cap.	Lbs. Ice	Evaporator F-Fedders N-Norge	Average Sleeve Temp.		SO_2 Charge Lbs.	Receiver Capacity Lbs.	Oil Charge Fluid Ozs.
		Int.	Ext.				Cut-In	Cut-Out			
1930											
4		Porc.	Lacq.	4.1	4.5	3-Tray F			2		
5		Porc.	Lacq.	5.2	6.3	4-Tray F	26°	14°		2¼	28
5AP		Porc.	Porc.	5.2	6.3	4-Tray F			2¼		
7		Porc.	Porc.	7.7	6.3	4-Tray F					
1931											
51		Porc.	Lacq.								
51P		Porc.	Porc.	4.1	4.5	3-Tray F	28°	19°	3½	4½	28
51S		Porc.	Lacq.								
61		Porc.	Lacq.	5.2							
61P		Porc.	Porc.		6.3	4-Tray F	28°	19°	4	4½	28
71		Porc.	Porc.	6.5							
1932											
A	42	Porc.	Lacq.								
B	52	Porc.	Lacq.	4.25	5.4	3-Tray F	27°	13°	5	6	28
BP	52	Porc.	Porc.								
D	62	Porc.	Lacq.	5.6							
DP	62	Porc.	Porc.	5.6	9	5-Tray F	27°	13°	5¾	6	28
F	72	Porc.	Porc.	6.8							
H	102	Porc.	Porc.	11.1	14.4	8-Tray N	20°	6°	3	6	28

General Information on Norge 1933 Units

Model	No.	Finish		Net Cab. Cap.	Lbs. Ice	Evaporators F-Fedders N-Norge	Average Sleeve Temp.		SO_2 Charge Lbs.	Receiver Capacity Lbs.	Oil Charge Fluid Ozs.
		Int.	Ext.				Cut-In	Cut-Out			
Early A-44	430	Porc.	Lacq.	4.4	4.5	2-Tray N	23°	9°	5	6	32-33
					5.4	3-Tray F			5	6	
Late A-44	430	Porc.	Lacq.	4.4	4.5	2-Tray N			5	6	
AP-44	40	Porc.	Porc.	4.4	4.5	2-Tray N	23°	9°	5	6	32-33
Early J	531	Porc.	Lacq.	5.17	4.5	2-Tray N	23°	9°	5	6	32-33
Late J	531	Porc.	Lacq.	5.17	6.75	3-Tray N			5½	6	
Early JP	53	Porc.	Porc.	5.17	4.5	2-Tray N	23°	9°	5	6	32-33
Late JP	53	Porc.	Porc.	5.17	6.75	3-Tray N			5½	6	
Early D-66	630	Porc.	Lacq.	6.62	6.75	3-Tray N	25°	8°	5½	6½	32-33
					9	5-Tray F			5¾	6	
Late D-66	630	Porc.	Lacq.	6.62	6.75	3-Tray N			5½	6	
DP-66	60	Porc.	Porc.	6.62	6.75	3-Tray N	25°	8°	5½	6½	32-33
D-5	530	Porc.	Lacq.	6.62	6.75	3-Tray N	25°	8°	5½	6	32-33
K	631	Porc.	Lacq.	6.06	9	4-Tray N	25°	8°	5½	6½	32-33
KP	63	Porc.	Porc.	6.06	9	4-Tray N	25°	8°	5½	6½	32-33
M	73	Porc.	Porc.	7.14	9	4-Tray N	24°	7°	5½	6½	32-33
R	853	Porc.	Porc.	9.08	9	4-Tray N with Fin	24°	11°	5½	6½	32-33
W	113	Porc.	Porc.	11.05	14.4	8-Tray N with Expansion Valve	20°	6°	3	6½	32-33

NOTE: Average sleeve temperature as specified in above table is determined with cold accelerator dial set midway between highest and lowest position.

SERVICE POINTERS

Symptoms, Causes and Remedies

1—EVAPORATOR DEFROSTING

Causes:

a—Overload cut-out tripped or fuse blown.
b—Cold accelerator not cutting-in soon enough.
c—Defective wiring connection.
d—Power shut-off at Central Station.
e—Belt broken.
f—Shortage of SO_2 in system.
g—Needle valve leak. (Expansion valve leak.)
h—Needle valve stuck closed, or plugged screen at evaporator or check valve.
i—Expansion valve out of adjustment.
j—Air in system.
k—Oil-logged evaporator.
l—Dirt-clogged condenser.

General Information on Norge 1934 Units

Model	No.	Finish		Net Cab. Cap.	Lbs. Ice	Evaporator N-Norge	Average Sleeve Temp.		SO_2 Charge Lbs.	Receiver Capacity Lbs.	Oil Charge Fluid Ozs.
		Int.	Ext.				Cut-In	Cut-Out			
S-47	440	Porc.	Lacq.	4.7	5¼	2-Tray N	23°	9°	5	6.94	32-33
S-55	540	Porc.	Lacq.	5.5	7⅛	3-Tray N	23°	9°	5½	6.94	32-33
L-54	541	Porc.	Lacq.	5.4	7¼	3-Tray N	23°	9°	5½	6.94	32-33
P-54	54	Porc.	Porc.	5.4	7¼	3-Tray N	23°	9°	5½	6.94	32-33
L-67	641	Porc.	Lacq.	6.7	9¾	4-Tray N	25°	8°	5½	6.94	32-33
P-67	64	Porc.	Porc.	6.7	9¾	4-Tray N	25°	8°	5½	6.94	32-33
S-71	640	Porc.	Lacq.	7.1	10½	4-Tray N	24°	7°	5½	6.94	32-33
P-78	74	Porc.	Porc.	7.8	9¾	4-Tray N	24°	7°	5½	6.94	32-33
P-91	854	Porc.	Porc.	9.08	9¾	4-Tray N	24°	11°	5½	6.94	32-33
P-110	114	Porc.	Porc.	11.05	14.4	8-Tray N with Expansion Valve	20°	6°	3	6.94	32-33

NOTE: Average sleeve temperature as specified in above table is determined with cold accelerator dial set midway between highest and lowest position.

m—Inefficient Rollator.
n—Connecting line restricted.

2—WILL NOT FREEZE DESSERTS OR ICE CUBES

Causes:
a—Too much sugar in desserts.
b—Acid content in desserts.
c—Alcoholic content in sherbet.
d—Desserts not made according to recipes.
e—Check troubles listed under **Evaporator Defrosting.**

3—FREEZES ICE BUT FOOD COMPARTMENT TEMPERATURE TOO HIGH

Causes:
a—Circulation of air in refrigerator restricted.
b—Evaporator heavily frosted.

4—ROLLATOR RUNNING HOT

Causes:
a—Improper location; too near heating system.
b—Improper air circulation around cabinet.
c—Air in system.
d—Corrosion in Rollator.
e—Dirt-clogged condenser.
f—Not sufficient oil in Rollator.

5—CONDENSING UNIT CEASES TO OPERATE—EVAPORATOR WARM

Causes:
a—Fuse blown out on unit or house circuit.
b—Cold Accelerator will not cut-in.
c—Overload cut-out tripped.
d—Defective electrical connections.
e—Power shut-off at Central Station.
f—Motor burned out.
g—Belt broken.
h—Refrigerator location too cold.

6—CONDENSING UNIT RUNNING CONTINUALLY

Causes:
a—Cold Accelerator not cutting-out.
b—Needle valve leak.
c—Expansion valve needle leak.
d—Insufficient amount of SO_2 in system.
e—Inefficient Rollator.
f—Oil in Rollator very low.
g—Excessively high head pressure.
h—Dirt-clogged condenser.
i—Circuit leading to control shorted in motor connecting box.

7—CONDENSING UNIT RUNNING TOO LONG

Causes:
a—Food compartment door left open.
b—Hot foods placed in refrigerator.
c—Worn hardware.
d—Defective door gaskets or door seal.
e—Improper location.
f—Box exposed to direct rays of the sun.
g—Too near heating system.
h—Overloaded with food.
i—Needle valve leak.
j—Expansion valve needle leak.
k—Insufficient amount of SO_2 in the system.
l—Belt too loose.
m—Inefficient Rollator.
n—Rollator low on oil.
o—Excessively high head pressure due to overcharge of SO_2 or air in the system.
p—Dirt-clogged condenser.
q—Partially plugged screen in evaporator or check valve.
r—Cold accelerator dial in a fast freezing position.
s—Cold accelerator bulb loose in evaporator clamp.

8—CONDENSING UNIT RUNNING ON SHORT CYCLE

Causes:
a—Defective cold accelerator.
b—Check valve leaking slightly.
c—Needle valve leaking slightly.
d—Expansion valve leaking slightly.

9—OVERLOAD CUT-OUT TRIPPING REPEATEDLY

Causes:

a—Low voltage.
b—Poor electric connections.
c—Short circuit in motor windings.
d—Belt too tight.
e—Rollator stuck.
f—Too much SO_2 or oil in the system.
g—Air in the system.
h—Short in cold accelerator.
i—Dirt-clogged condenser.
j—Improper overload element in cold accelerator.

10—NOISY CONDENSING UNIT

Causes:

a—Motor pulley or fan loose.
b—Rollator flywheel loose.
c—Flywheel and pulley out of alignment.
d—Rough belt.
e—Incorrect tension on belt.
f—Belt squeak.
g—Rollator loose on base.
h—Motor loose on base.
i—Too much end play in motor.
j—Rollator seal squeak.
k—Connecting lines touching chassis or cabinet.
l—Shipping bolts and spacers not removed.
m—Shortage of oil in Rollator.
n—Unbalanced or bent fan blades.
o—Unit suspended on improper suspension springs.
p—Suspension spring off bracket or base slot.

11—LEAKING NEEDLE VALVE ASSEMBLY

Causes:

a—Dirt.
b—Corrosion.
c—Rough needle point or rough valve seat.
d—Shortage of SO_2 in system.

Symptoms:

Slight Needle Valve Leak:

a—Slightly longer running period with slightly shorter off period.
b—Tendency of suction line to frost or sweat.
c—Slight hissing sound at evaporator for a minute or two after unit has stopped running.
d—Metallic click at Rollator for a few seconds at the start of each running cycle.

Large Needle Valve Leak:

a—Higher evaporator temperature.
b—Long running periods—possibly continuous—and very short off periods.
c—Frosting and sweating of the suction line to Rollator.
d—Continuous hissing sound at evaporator head.
e—High suction pressure.
f—Metallic click at Rollator for a long period at the start of each running cycle.

Remedy:

Dirt. Flushing needle valve assembly. If this does not correct the trouble, the needle valve assembly will have to be changed.

Corrosion. Rough needle point or seat. Change needle valve assembly.

Shortage of SO_2. Determine if shortage is due to SO_2 leaking out of system; if so, repair leak and add SO_2. After sufficient SO_2 has been added, check operation of unit through a complete cycle, to determine if trouble has been corrected.

12—NEEDLE VALVE ASSEMBLY STUCK SHUT

Causes:

a—Air and moisture leak into low side of system.

Symptoms:

a—Little or no refrigeration.

Remedy:

Change needle valve assembly.

13—EXPANSION VALVE NEEDLE LEAK

Causes:

a—Dirt.
b—Corrosion.
c—Rough needle or seat.

Symptoms:

Slight Leak:

a—Suction pressure slightly higher than normal.
b—Tendency of suction line to sweat or frost at start and end of cycle.
c—Slight hissing sound at expansion valve with Rollator stopped.
d—Slightly longer running time.

Large Leak:

a—High suction pressure.
b—Heavy frosting of suction line to Rollator.
c—High cabinet temperatures.
d—Long or continuous running time.
e—Defrosting evaporator.
f—Continuous hissing sound at expansion valve.

Remedy:

Flush expansion valve. If this does not remedy leak, change expansion valve.

14—PLUGGED EVAPORATOR LIQUID LINE SCREEN

Causes:

a—Dirt or moisture in system.

Symptoms:

a—Low reading on gauge in valve "S."
b—Defrosted evaporator.
c—Continuous running of condensing unit.

Remedy:

Remove, clean and replace screen.

15—CHECK VALVE LEAK

Causes:

a—Dirt.
b—Corrosion.
c—Rough seat.
d—Defective disc.
e—Defective spring.

Symptoms:
a—Excessive vibration and noise at the beginning of every cycle.
b—Warm suction line when Rollator stops.
c—Gurgling sound at check valve when Rollator stops.
d—Condensing unit running on short cycle.

Remedy:
Remove, clean and examine check valve, and change if necessary.

16—TOO MUCH SO_2 IN THE SYSTEM

Causes:
a—SO_2 added when not needed.

Symptoms:
a—Upper condensing coils hot, and lower portion of condenser abnormally cool.
b—High condenser pressure as determined by gauge.
c—Overload cut-out tripped or fuse blown.

Remedy:
Purge out some of the SO_2.

17—INSUFFICIENT SO_2 IN SYSTEM

Causes:
a—Seal leak or loose flare connection.
b—Lost by excess purging of system.

Symptoms:
a—Warm condenser, receiver and liquid line.
b—Continuous hissing sound at evaporator needle valve.
c—Suction pressure higher than normal.
d—Head pressure lower than normal.
e—Long or continuous running.
f—Completely or partially defrosted evaporator.

Remedy:
a—Locate and repair leak.
b—Add SO_2 to system.

18—AIR IN THE SYSTEM

Causes:
a—Leak in the low side of the system.
b—Incomplete purging of the lines.

Symptoms:
a—High condenser pressure, with normal condenser temperature.
b—Overload cut-out tripped or fuse blown.

Remedy:
Purge system of air.

19—INSUFFICIENT COOLING OF CONDENSER

Causes:
a—Cabinet too close to wall. (Ventilating spacer block not installed.)
b—Flow of air through condenser obstructed by dirt and lint.

Symptoms:
a—Condenser, receiver and liquid line are warm.
b—Rollator very warm.
c—High condenser pressure.
d—Evaporator defrosting.
e—Overload cut-out tripping.
f—Motor over-heating.
g—Continuous running of condensing unit.

Remedy:
a—Move cabinet at least two inches away from wall and install ventilating block.
b—Clean all dirt and lint from condenser, using a small stiff brush or vacuum cleaner.

20—ROLLATOR SEAL LEAK

Causes:
a—Dirt between sealing surfaces.
b—Rough surface on seal face.
c—Cracked seal bellows or improper soldering.
d—Corrosion.

Symptoms:
a—SO_2 leaking out around the Rollator shaft and large amount of oil leaking from Rollator.

Remedy:
Permit unit to run for about one-half hour. Replace seal assembly, if not corrected by running.

21—INEFFICIENT ROLLATOR

Causes:
a—Broken blade spring.
b—Stuck blade.
c—Lack of oil in Rollator.
d—Scored roller.
e—Leaky discharge valve.

Symptoms:
a—Little or no refrigeration.
b—Cool Rollator, condenser and receiver.
c—Low head pressure.
d—High suction pressure.

Cause a:
Discharge Rollator and replace blade spring.

Causes b, d and e:
Change Rollator and return it to the shop.

Cause c:
Determine if shortage is due to leak or to oil-logged evaporator; if due to leak, locate and repair leak and add sufficient oil to bring charge up to normal. If shortage is due to oil-logged evaporator, return oil to Rollator.

Note—Only flooded type evaporators may become oil-logged; this condition cannot occur with dry expansion evaporators.

22—ROLLATOR STUCK

Causes:
a—Moisture in system due to a leak on low side.
b—Negligent service.

Symptoms:

a—Overload cut-out tripped.

b—Rollator flywheel cannot be turned by hand; or, can be turned only with difficulty.

c—Seal leak.

Remedy:

Change Rollator and return same to repair shop.

23—AIR CIRCULATION IN REFRIGERATOR OBSTRUCTED

Causes:

a—Food stuffs packed too closely on shelves.

b—Shelves covered with paper.

c—Insufficient space between sides of evaporator and ice compartment walls due to evaporator being frosted too heavily.

Symptoms:

a—Ice freezes but food spoils.

b—Spoiled food odors.

Note: Milk, butter and water should be kept in closed containers, as they will absorb odors from other foods.

Remedy:

Remove obstruction and defrost.

24—ODORS IN REFRIGERATOR

Causes:

a—SO_2 leak at evaporator or at connecting lines within refrigerator.

b—Circulation of air obstructed.

c—Decayed foods in refrigerator.

d—Odorous foods in open containers.

Symptoms:

a—Foods, especially milk and butter, becoming tainted.

Remedy:

a—Identify, locate and remove cause. Wash the interior of the refrigerator thoroughly with lukewarm soda and water solution.

b—Place about a cupful of fine charcoal in a porous clean bag (cheese cloth) and suspend from lower shelf in cabinet for two weeks or more.

Note: Charcoal tends to absorb any foreign odors in the cabinet.

25—COLD ACCELERATOR TROUBLES

Causes:

a—Loose clamp.

b—Loss of charge in bellows.

c—Bellows not screwed tightly in bakelite cover.

d—Worn over-load cut-out ratchet.

e—Sticky switch mechanism.

f—Differential adjustment too wide.

Symptoms:

a—A loose clamp will cause motor to run too long, resulting in too cold a cabinet because the switch does not cut-out.

b—If the charge has leaked out of the bellows, the motor will not run when the switch is in the "ON" position and the evaporator is warm.

c—With the bellows slightly loose in the bakelite cover, the motor will not cut-in automatically at every cycle, even though the switch is in the "ON" position. A slight finger pressure on the defrosting switch lever toward the "ON" position will, however, cause the motor to start and continue to run for a cycle or two.

d—The defrosting switch will not stay in the "ON" position but immediately snaps back to the "OFF" position, with a normal load on the motor it is an indication that the over-load cut-out ratchet is worn.

e—A sticking switch mechanism will cause the machine to run very irregularly; also, will keep it from stopping and starting at the proper temperature.

f—Too wide a differential will cause the machine to operate on a very long cycle, or the temperature may vary between the cut-in and cut-out period.

Remedy:

a—To correct this trouble, it is necessary only to tighten the clamp.

b—Before proceeding further, screw bellows tightly in place. Then, if motor does not run with switch in "ON" position and there is no open electrical circuit, replace the cold accelerator.

c—Screw bellows tightly in place. Unless the bellows is screwed tightly into place, even though the refrigerator operates automatically, the cold accelerator setting may vary and may not maintain the temperatures desired.

d—If the overload cut-out is operated due to an abnormal load condition, it will not be possible to reset it for a few moments as time must be allowed for the over-load coil to cool.

e—Replace cold accelerator.

f—Replace cold accelerator.

Jack Paul,
California.

"I have read in past issues where subscribers say the same thing I do, that the REFRIGERATION SERVICE ENGINEER is a wonderful magazine."

Henry E. Meyer,
Michigan.

"I enclose money order for continuation of my subscription. Please send me the September issue as I don't want to miss a copy. I think the little magazine is great."

George E. Moon,
Illinois.

"It is with pleasure that I am mailing my renewal for the REFRIGERATION SERVICE ENGINEER. Your magazine has been of much interest and benefit to me, so much in fact that I should hate to miss a single issue."

Diagnosis of Motor Troubles

Refrigerator Motor Breakdowns Comprise a Large Percentage of Service Calls. This Article Suggests Repairs Which Can Be Made in the Field and Others Which Require Shop Attention.

By GEORGE C. TATEM *

IT has been quite interesting to note the foothold which Service as a whole has taken in industries during the past several years. We believe that most of us can recall the "hey-days" of more prosperous years when Service was looked upon with a frown and sales the thing of the hour. Today Service has most assuredly come into its own, and the service men, that is good service men regardless of what field they may be in, are certainly at a premium. Sales managers and executives the world over now appreciate the fact that it is the service behind their product which is putting their own particular article over, rather than the high pressure sales methods which were used during the years of '28 and '29. And—what industry needs efficient service more than the refrigeration business as a whole; the very life of the manufacturers depend largely today upon the prompt and efficient Service its organization is in a position to render.

It has been our lot to be directly connected with the refrigeration industry in servicing and handling refrigeration motors. Fortunately or unfortunately, depending entirely upon which way you look at it, electric refrigeration motors are a unit which is rather difficult to service in the field, repairs and adjustments are naturally restricted to minor ailments. We are of the opinion that with some exceptions, the average service man does not have sufficient knowledge of either electricity or a motor to attempt major adjustments without removing the unit. In this category we refer to such things as governors, brushholders, short circuiting devices, etc.

We are therefore going to endeavor to outline adjustments which it is possible to make in the field without removing the motor to a repair shop, as well as outline later in this resumé the care which should be executed in selecting a motor repair shop to handle repair work which is beyond attention in the field:

Service Hints

1. One point which we would like to bring out first and most emphatically, and if we could but leave this one impression on the minds of every service man and service manager who may read this article, the importance of properly fusing a motor after it is installed, we will have considered our time well worth while and likewise that we have contributed something to the industry in bringing about lower maintenance service costs. The neglect and judgment which are used in fusing a motor do, without a doubt, amount to untold thousands of dollars in service over a period of one year. It is usually recommended that a fuse not exceeding 50% of the nameplate reading be used, as an illustration: a motor rated at 4 amperes, 110 volt, would be properly fused using a 6 ampere fuse. Anything over this endangers the motor, and a great deal of major motor problems would be eliminated if it could but be sold to service men that a properly rated fuse, even though it may mean an additional service call, would decrease the maintenance cost of the firm with whom he may be connected.

2. We strongly recommend to all service managers that they furnish their service men with an Ammeter and that this unit be carried at all times in their service kit, this would increase the efficiency of rendering service in the field, inasmuch as it would enable the service men to give a motor a quick test. The test of amperes should be given while the motor is idling (belt disconnected),

* President, Electric Refrigeration Motor Co.

if ampere reading shows same or less than nameplate reading, the motor itself is o.k., the belt should then be attached and a reading taken while the unit is in operation; an additional ampere reading above 25% over the nameplate reading would indicate an overload (this same condition could be detected by a decrease in r.p.m.s) and the trouble should be looked for in the refrigeration system. Overloading is the source of a large percentage of motor troubles.

3. A great deal of radio interference and other noise can be eliminated if a motor is properly grounded. This likewise lessens the danger of anyone being shocked.

4. It is very easy to determine whether a motor is completely burned out by merely glancing at the nameplate. If it is burned or red in color, it is a good indication that the motor is burned out.

5. We believe that the majority of service men today can readily detect bearing wear, and when servicing a refrigerator this should be one of the things to receive his immediate attention, inasmuch as a badly worn bearing will permit the armature to drag against the laminations of the stator and will also cause the consumption of more electric current.

6. Practically all service men today replace brushes in the field. This in some respects has been a bone of contention, due to the fact that the brushes have not been properly seated, and we strongly recommend that a brush seater stone be used after new brushes are installed, and that the brushes be properly seated before leaving the job.

7. If the motor does not come up to speed on the start, take your watch and time the motor and count the number of seconds it takes for the unit on the repulsion, then mark brushholder setting; move the brushholder about ⅛" against rotation, check motor again to see if you have caused it to gain speed. If not, move brushholder ⅛" from original brushholder setting in direction of rotation and check again. If any speed is gathered, check temperature of motor for heating up, and if it is found to be above 180° Fahrenheit and you are sure the com-

(Continued on page 18)

WATER COOLING SYSTEM

By JOHN ELLISON, Refrigeration Engineer

THE diagram on the following pages shows an automatically controlled water cooling system of the closed type. This system takes advantage of the city water pressure for carrying the water to the various drinking fountains in the building, thus reducing the amount of power required for the circulating pump, which simply keeps the water in motion. The water from the city main flows through a filter to the cooling tank. This tank should be insulated with at least four inches of some good insulating material.

Piping Design

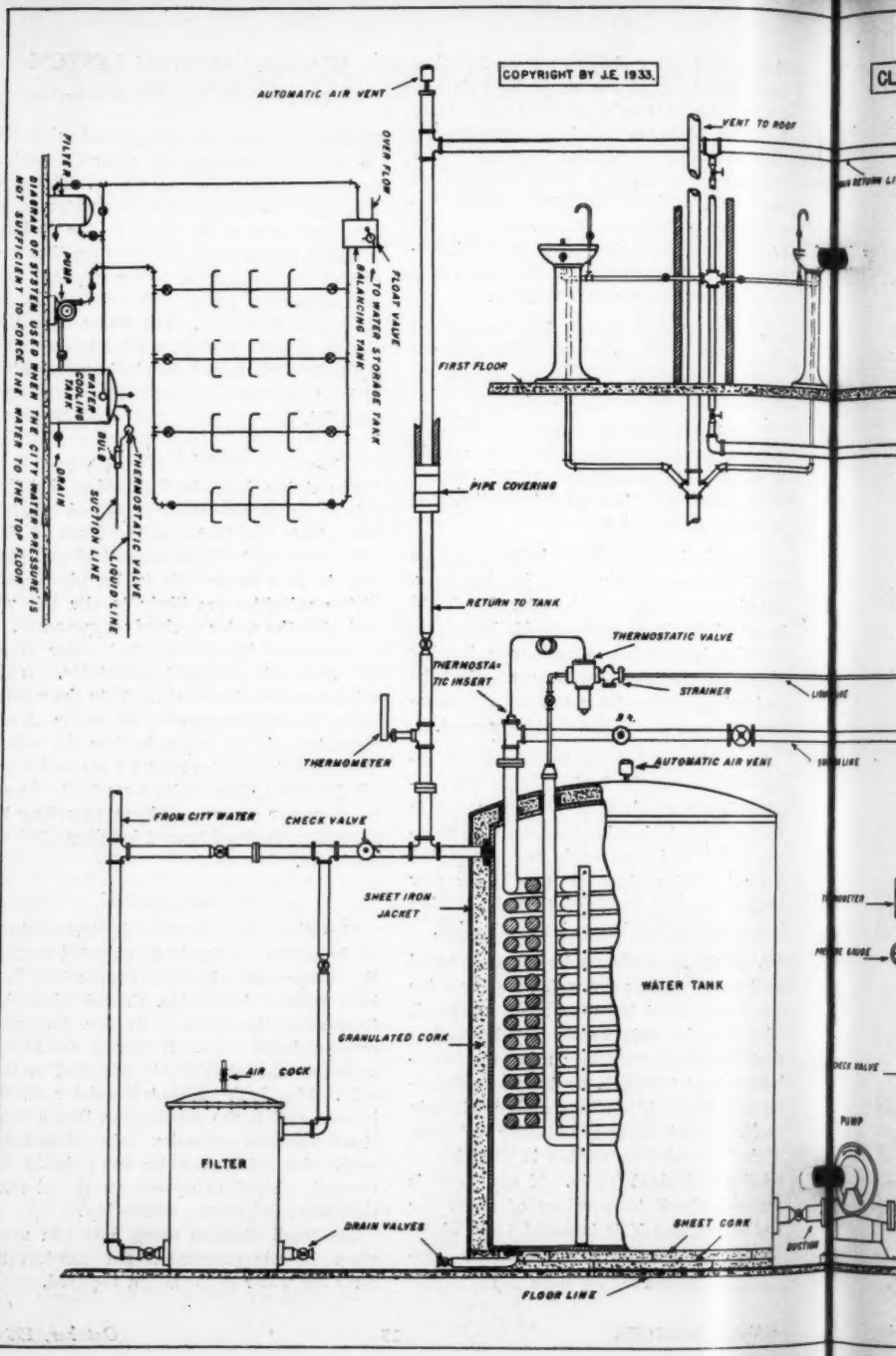
The piping should be designed so that the velocity of the water will not exceed 185 feet per minute for best results. Even if the water is filtered a small amount of sediment may in time accumulate in the pipes, and higher velocities are likely to stir this up and give the water a cloudy appearance.

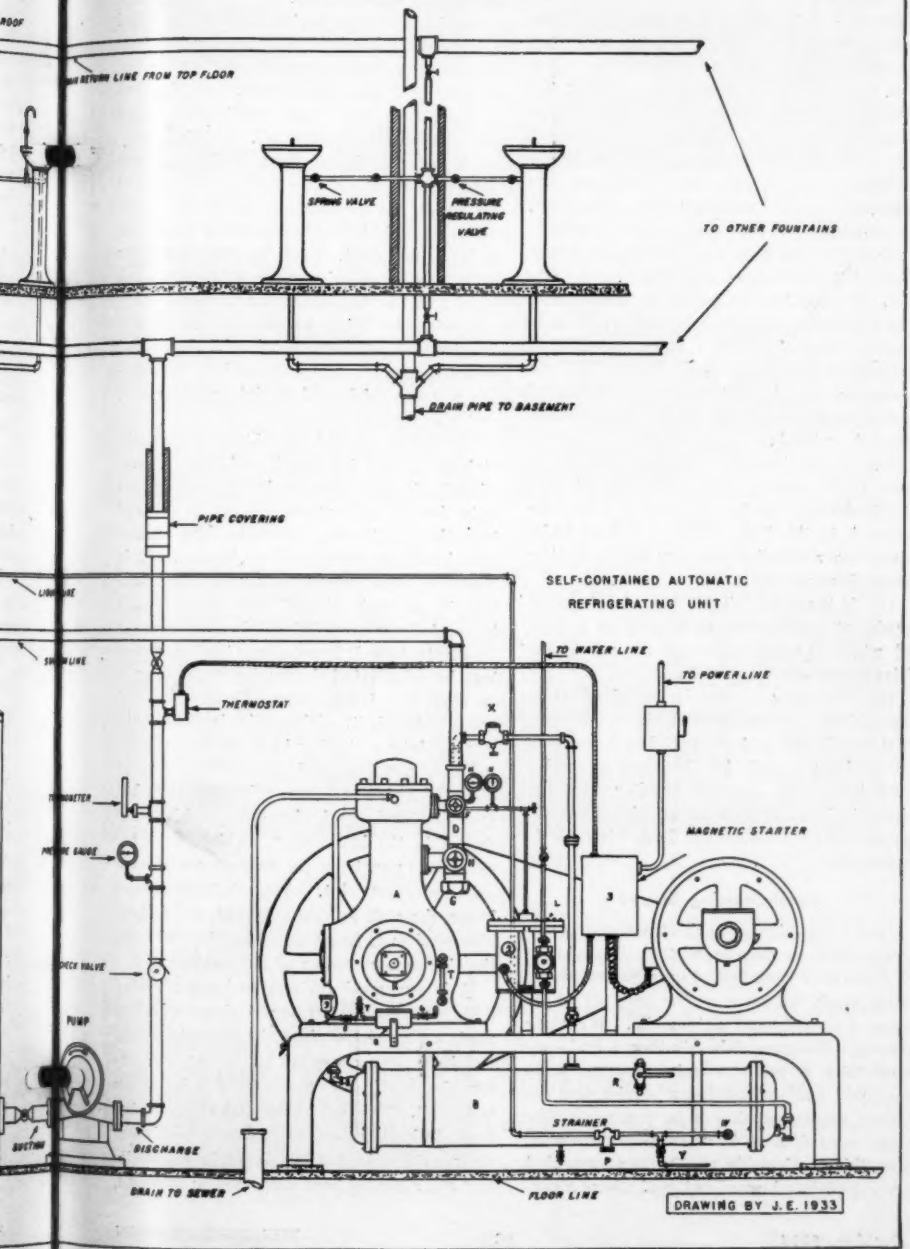
Experience has proven that water from 45° to 50° is the most acceptable. With a temperature rise of about 5° in the return main, the temperature of the water at all fountains will be approximately the same. The amount of water required for each person in the building varies from 0.1 to 0.4 of a gallon per person per hour, according to climatic conditions, type of building, kind of work, etc.

Thermostat Control

The thermostat controls the temperature of the water. It should be adjusted to stop the compressor when the temperature has been reduced to 44 deg. F. and when the temperature has risen to 47 deg. the compressor should start. A thermo valve controls the amount of liquid admitted to the coils. If a back pressure regulator B. R. is connected in the suction line, then a constant pressure expansion valve should be used. All drinking water lines should be covered, otherwise they will sweat and considerable refrigeration will be lost.

The small diagram shows a system used when the city pressure is not sufficient to force the water to the height required.


COPYRIGHT BY J.E. 1933.
AUTOMATIC AIR VENT
VENT TO ROOF
OVER FLOW
FLOAT VALVE
TO WATER STORAGE TANK
BALANCING TANK
FILTER
PUMP
WATER COOLING TANK
BULB
SUCTION LINE
LIQUID LINE
THERMOSTATIC VALVE
DRAIN
DIAGRAM OF SYSTEM USED WHEN THE CITY WATER PRESSURE IS NOT SUFFICIENT TO FORCE THE WATER TO THE TOP FLOOR
FIRST FLOOR
PIPE COVERING
RETURN TO TANK
THERMOSTATIC VALVE
THERMOSTATIC INSERT
STRAINER
THERMOMETER
AUTOMATIC AIR VENT
FROM CITY WATER
CHECK VALVE
SHEET IRON JACKET
WATER TANK
GRANULATED CORK
AIR COCK
FILTER
DRAIN VALVES
SHEET CORK
FLOOR LINE


CLOSED TYPE WATER COOLING SYSTEM
RETURN LINE FROM TOP FLOOR
SPRING VALVE
PRESSURE REGULATING VALVE
TO OTHER FOUNTAINS
DRAIN PIPE TO BASEMENT
PIPE COVERING
SELF-CONTAINED AUTOMATIC REFRIGERATING UNIT
TO WATER LINE
TO POWER LINE
THERMOSTAT
MAGNETIC STARTER
PUMP
STRAINER
DISCHARGE
DRAIN TO SEWER
FLOOR LINE
DRAWING BY J.E. 1933

MOTOR TROUBLES

(Continued from page 15)

pressor is o.k., there is a possibility that either the armature or the stator is shorted or that the bearings are worn.

8. A very exact test in determining whether or not an armature is shorted is to turn off the switch and lift the brushes off the commutator, then turn on the switch and continue to hold brushes off commutator with left hand, revolve armature with right hand. If armature will not turn, or has a tendency to lock it is shorted. If the armature is not shorted it will revolve very freely.

9. If excessive brush wear is experienced, check armature for an open circuit. This is readily determined by a close examination of the commutator; where you can see the insulation or mica between the segments of a few commutator bars being charred, discolored or black.

10. It has been a common practice for some service men to use a file and endeavor to file the face of the commutator while the motor is in the field. This we believe to be a very poor practice and very costly, as it is never done properly.

11. It is most advisable to use a standard grade of medium automobile oil or special oil which is made expressly for use in refrigeration motors.

12. We have purposely refrained from discussing Capacitor motors, due to the fact that we do not believe that they have been in use long enough for the average service man to become entirely familiar with the characteristics of these units aside from the possibilities of shimming them where it is necessary.

Reconditioning Motors

In our experiences in the fractional horsepower field, we have found that the majority of executives have looked upon motor repair work much the same as the most of us do upon a second-hand automobile. We quite strongly disagree with this theory and contend that a motor repair shop properly equipped and managed can service and repair a motor, putting it in practically the same condition as it was when purchased new, this particularly applies to motors that are completely burned out, and where a saving of approximately 35 to 45% is involved, we believe that it becomes quite an item in decreasing service costs.

We have, over a period of years, handled a large portion of refrigeration motors along the entire eastern seaboard, and out of the thousands of motors reconditioned, the percentage that come back within one year's time has been practically nil. This is largely attributed to the modern equipment and skillful help which we employ, and last but not least the breakdown test which every motor is subjected to before being permitted to leave our plant. Each motor is tested for every known condition which it may be called upon to do in its line of duty. We are endeavoring to bring to you, in the photographs that you will find inserted on these pages equipment which is used in the servicing and repairing of electric refrigeration motors.

There is one policy which you should strictly adhere to, and that is, in no case when having a motor repaired permit the repair shop to cut out one coil or to attempt to make repairs to a coil when the insulation has been more or less burned. It is likewise an important factor that the windings be properly dipped in a varnish which is specially prepared for this purpose. As an illustration: it is necessary that the windings be dehydrated thoroughly by heating in an oven at a temperature of approximately 250° Fahrenheit. The unit is then submerged into a dipping tank of Hygrade insulation varnish. Of course the unit is dipped into the cold varnish while it is hot and the tendency is for the varnish to be drawn to the hot copper. This causes the varnish to penetrate the very center of each coil and every slot. After baking several hours the unit is again dipped and baked. The number of hours of baking depend upon the size or horsepower of the motor.

It is our good fortune to have affiliated with our organization, an engineer who has made a very thorough study of refrigeration requirements as applied to the electric motor, in particular the repulsion-induction type unit. Through a thorough study of the needs in having a motor protector which was fully automatic and which would adjust itself after having been subjected to overload,

FIG.

FIG.

FIG.

FIG.

SERVI

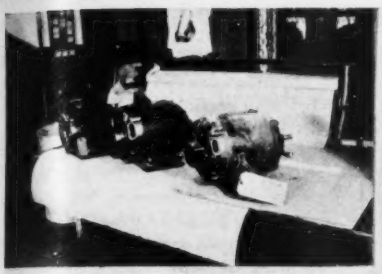


FIG. 1

FIG. 2

FIG. 3

FIG. 4

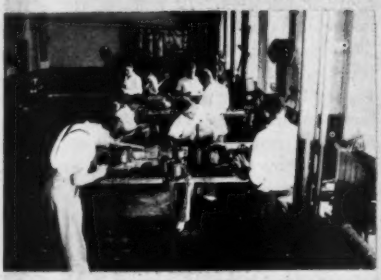


FIG. 5

FIG. 6

FIG. 7

FIG. 1. THE OLD STORY—Before Repairs, a Repaired Motor and a New Motor.

FIG. 2. MACHINE SHOP—Special Tools Made for Production Work on Refrigeration and Oil Burner Motors.

FIG. 3. INCOMING MOTORS FOR REPAIRS.

FIG. 4. MOTORS REPAIRED, Waiting to Be Re-finished to Give Appearance of New Motor.

FIG. 5. ARMATURE & STATOR WINDING DEPARTMENTS. Old Windings Removed and Cores Cleaned.

FIG. 6. GENERAL SHOP-MOTORS REPAIRED AND FINISHING TOUCHES.

FIG. 7. HYDRAULIC BRAKE TEST, on Which Motors Are Given Breakdown Test After Repairs Have Been Completed.

or low voltage, or any of the numerous conditions which we run into in refrigeration service and which are all detrimental to the electric motor, he has developed and perfected a unit which is now available, known as the Ermstat, which will prevent a motor from burning out under any and all of the above stated conditions.

In the final analysis, the life of the refrigeration industry depends largely upon the kind and type of Service which is rendered by the individual service man, regardless of whom he may be working for, and we feel that it behooves each and every one directly connected with service to give a little more attention to the electric motor if they desire to decrease their service calls and likewise their service expenses. The electric motor is of mechanical operation the same as the compressor, parts do wear out, insulation does deteriorate, and if more care would be given along the lines of maintenance and proper training of the service man, a great deal could be accomplished.

The Control of Refrigerants . . .

ARTICLE NO. 14
APPLICATION OF MAGNETIC SUCTION LINE STOP VALVE

This Article Describes the Various Applications for the Magnetic Suction Line Stop Valve. Service Pointers on Some Possible Valve Troubles.

By J. L. SHRODE *

THE magnetic suction stop valve is used in frosted refrigerant lines as a suction line shut-off or as a low side by-pass valve.

Series System

This valve makes possible the individual control of two or more evaporators fed in series on either a flooded or direct expansion system. Each evaporating unit in such a system is by-passed with a magnetic suction valve opened and closed automatically by a thermostat placed in that unit. When the unit comes down to temperature, the thermostat opens the valve, thereby permitting the refrigerant to by-pass around the evaporator. After the room temperature rises, the valve closes and refrigeration again takes place. Whenever any room is cold enough the refrigerant is by-passed around its evaporator coils until it again requires refrigeration. Sometimes it is necessary to by-pass only one or two rooms of a series if the temperature of the other rooms need not be very constant.

Water Cooler Control

The automatic control of a water cooler in a series system is a good example of the above application. In a water cooler it is important that a constant temperature be maintained and that the temperature never becomes low enough to freeze the water. Figure 1 shows a water cooler connected in series with several evaporators and automatically controlled by means of a magnetic suction valve in a by-pass around it. Here a standard immersion type thermostat with the bulb in the water operates the magnetic valve. Whenever the temperature of the water becomes low enough the refrigerant is by-passed around the cooler.

Multiple System

In a multiple system, controlled by thermostatic expansion valves, it is frequently advantageous to use a magnetic suction shut-off valve in the suction line of one or more units before it joins the main suction header. Figure 2 illustrates such a system. This is particularly so where there is a difference of 20° or more in the temperatures maintained in the several units. When the liquid feed to the high temperature unit is shut off, for example, the refrigerant in its evaporator would condense in the colder units and

* President, Alco Valve Co.

refrigeration would continue. This would also temporarily retard the cooling of the low temperature units. By using a magnetic suction valve in the suction line from the high temperature unit, which closes automatically when the liquid stop valve closes, refrigeration will stop immediately, since both ends of the evaporator will be closed.

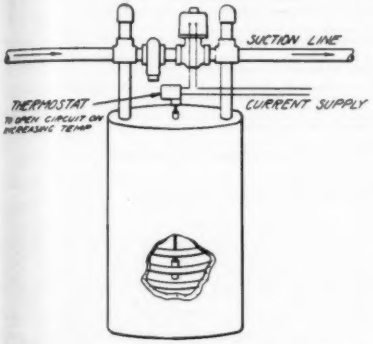


FIG. 1. WATER COOLER HOOK-UP.

Temperature Control of Flooded Systems

The magnetic suction valve provides a means of automatically controlling the temperatures of several units in a multiple flooded system. In order to maintain a constant temperature in a unit cooled by a flooded evaporator, it is necessary to shut off the suction outlet of the evaporator whenever the temperature is too low. Since the flooded evaporator is always practically full of liquid it is impossible to satisfactorily control the temperature by regulating the inlet feed. Even though the inlet may be closed the liquid in the evaporator would continue to boil off and further refrigerate the unit. It is obvious, then, that such a system must be controlled from the suction outlet. Each unit is controlled by a thermostat and a magnetic suction valve. Whenever any unit is down to temperature, the magnetic valve in its suction line closes and refrigeration stops. As soon as the temperature rises the valve opens and refrigeration again takes place. A typical application of this method of control is the usual flooded type milk cooler. An immersion thermostat or a suction pressure switch operates the magnetic suction valve to maintain a constant milk temperature. Such an installation is shown in Figure 3.

Ice Cream Freezer Control

The magnetic suction valve is used on flooded ice cream freezers. Here the valve

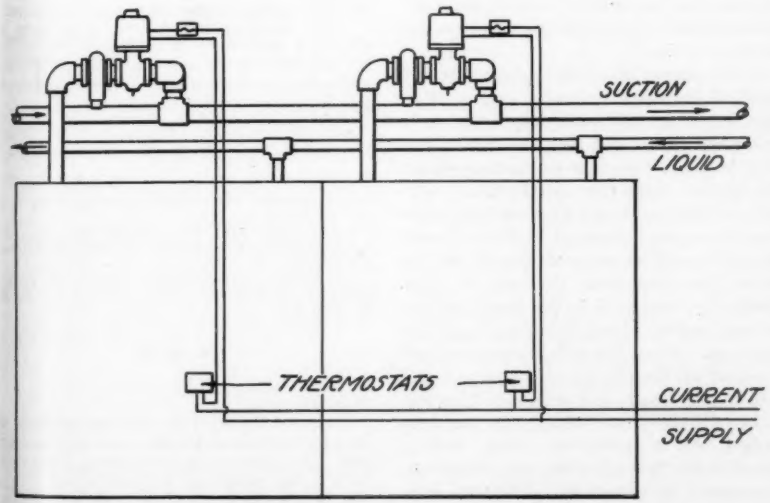


FIG. 2.

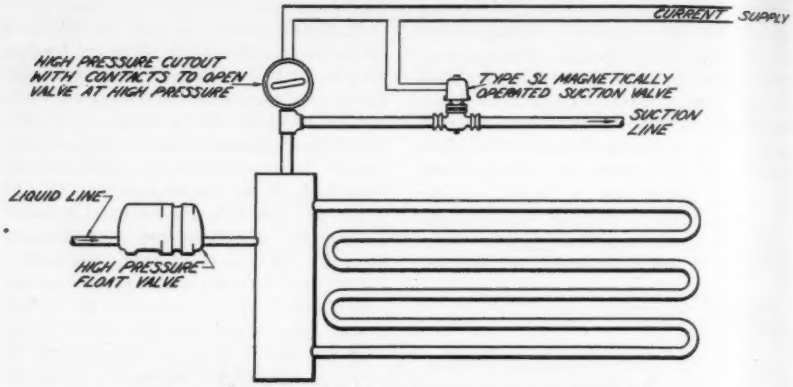

CURRENT SUPPLY
HIGH PRESSURE CUTOUT WITH CONTACTS TO OPEN VALVE AT HIGH PRESSURE
TYPE SL MAGNETICALLY OPERATED SUCTION VALVE
SUCTION LINE
LIQUID LINE
HIGH PRESSURE FLOAT VALVE

Fig. 3. TEMPERATURE CONTROL OF FLOODED SYSTEMS.

is installed in the equalizer pipe between the freezer and the header. When the suction valve closes, a pressure builds up inside the freezer and forces the liquid refrigerant out of the freezer into the header. Refrigeration in the freezer stops and since the pressure in the freezer rises, its temperature also rises. This is a condition desired during the whipping or over-run period.

Possible Magnetic Suction Valve Troubles

In general, if a magnetic suction valve fails to function properly either the valve piston is not seating tightly or the magnet coil is burned out.

A filter should always be installed directly ahead of the magnetic suction valve. Foreign matter in this valve may cause it to leak when closed and may also cause it to stick in either the open or closed position. The piston construction of the usual magnetic suction line stop valve requires rather close clearances between the valve walls and the piston and an accumulation of dirt between them may cause the valve to stick. Should the valve stick in the closed position for any length of time, the magnet coil may burn out. When the coil is energized and it cannot lift the plunger all the way, it will heat up abnormally and eventually burn out.

Over voltage or low voltage may cause the magnet coil to burn out. Over voltage causes undue heating of the coil. Low voltage materially reduces the pull of the magnet and if the voltage is low enough the coil will not have sufficient power to completely lift the plunger and will heat up. Prolonged heating of the coil due to either of these causes may result in a burned out coil. The use of proper fuse protectors will protect the coil against burning out due to abnormal voltages.

S S S

T. Bettinger,
Nebraska.

"I sure think that you have 'the magazine for the refrigeration service organization.' I enjoy reading every issue and there is always a good writeup on a subject that is of interest to the service man. The new series by Mr. J. B. Cook is fine and I think will help a lot of us."

S S S

Los Angeles, Cal.—The Jackson Engineering Co. has engaged in refrigeration appliance business at 112 W. 9th St.

Los Angeles, Cal.—The Carbonic Specialties Co. has engaged in the refrigerator appliance business at 652 East 61st St.

Los Angeles, Cal.—The Frigid Service Co. has engaged in refrigeration service business at 1045 S. Western Ave.

S S S

T. B. Welch,
Massachusetts.

"I would like to take this opportunity to let you know how helpful and instructive I find THE REFRIGERATION SERVICE ENGINEER. It is a fine magazine and one which I hope will be a part of my library for a long time to come."

Building "Off-Peak" Servicing

This Article Continued from the September Issue Shows Other Considerations in Oil Burner Servicing. Many Service Men Are Investigating the Possibilities of Building "Off-Peak" Servicing Through Oil Burner Service Work.

IT is the purpose of these articles to point out some of the more important considerations in oil burner servicing. Accurate instruments enable the service man to detect faults which may not be entirely due to mechanical difficulties but are nevertheless service calls.

The first article pointed out the importance of proper combustion through correct draft regulation.

This article which contains excerpts from articles by P. E. Hansler, editor of *Oil Heating* and reprinted with permission of The Hays Corp'n, points out the requirements for checking the installation and some field experiences.

Up to this point we have been interested only in finding the draft intensity of the chimney. This is because we must have a chimney with minimum draft-intensity ability so that, on days when atmospheric conditions are unfavorable, the draft intensity in the combustion chamber will not fall below the minimum required for complete combustion. Excess chimney draft also provides a margin of safety against the production of a positive pressure in the combustion chamber, which would cause combustion gases to be forced out into the basement or, what would be worse, where the burner is firing a leaky furnace, the gases would be forced into the jacket of the furnace and so through the registers into the house, too. So, while we talk so much about chimney draft, it really is the combustion-chamber draft that we are concerned with, and this factor should be determined when the burner is installed and adjusted.

Atmospheric Burners

With burners of the type which introduce practically all of the primary air for combustion along with the oil, there usually is required from .03 to .06 draft in the combustion chamber. With burners of the type which depend in part, or wholly, on the chimney draft to draw in air to support combustion, the combustion-chamber draft should be between .04 to .09, depending upon the burner characteristics.

To determine the combustion-chamber draft, drill a hole through the firedoor so the draft-gauge tube can be inserted, and the draft determined as it was for the chimney. It will not do to "crack" open the firedoor and insert the tube, as the opening between the door and frame will admit a lot of air over the fire and give you a false reading. As a matter of fact, *all* cracks around doors should be sealed before the burner is considered ready to leave. If you drill a ¼-in. hole through the door and tap it, a plug can be used to close the hole and can be removed at any time you want to make a check reading.

When you have found the combustion-chamber draft, hook up the gas analyzer and take a reading of the combustion gases *between* the boiler bonnet and any smokepipe dampers. Then adjust the oil-and-air ratio of the burner to give, if possible from 10% to 12% CO_2, watching the combustion-chamber draft meanwhile. The higher the CO_2, as a rule, the more critical the burner operation, and you undoubtedly will arrive at a point where you will have a fine CO_2 but an unstable operation, due to cutting the draft in the combustion chamber too low. When you have reached this point, ease up on the CO_2 to a point where the burner is stable, which will be from 0.5% to 1.5% less than this ideal maximum. Then the burner will not be operating "on the edge," and liable to cut up and smoke if the atmosphere gets soggy or heavy.

Draft Regulator Essential

The service manager of a large and successful burner manufacturer recently said: "It is absolutely impossible to have an efficient burner installation without the use of

an automatic draft regulator. And it is impossible properly to set a regulator without a draft gauge." I might add that the doctor can see that you have a fever, but he wants to *know* its intensity, so he sticks a thermometer under your tongue. In like manner, you can't determine flame temperature, or combustion efficiency, or draft without the proper instrument. I've never known a dealer to use instruments and then go back to the slipshod method of guessing, and I've talked to many who consider their thermometers, analyzers and gauges as indispensable as their pipe-cutting and other shop tools.

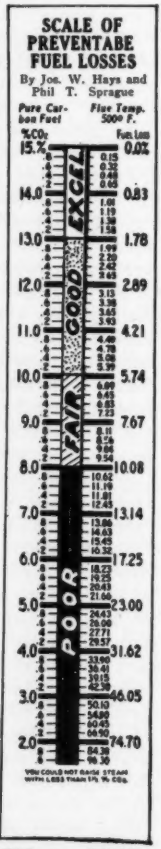


FIG. 1. SCALE OF PREVENTABLE FUEL LOSSES.

Referring to the Scale of Preventable Fuel Losses (Fig. 1), which has been calculated for pure carbon—and varies but little with the fuels commonly used for domestic heating—you will see that 12% CO_2, which is the maximum recommended for fully automatic domestic burners, corresponds to a preventable fuel loss of only 2.89%, with flue-gas temperature of 500°. This means that you are giving your customer a combustion efficiency mighty close to 100%, and you will have no fear of complaint of excessive fuel bills. If, on the other hand, you had followed what is too common a practice of setting the burner by eye, with resulting CO_2 between 5% and 8%, you would be permitting from 10% to 25% of your client's oil to go out the stack.

I would strongly urge that a record of every installation be filed for future reference and check. (Fig. 1.)

Some Field Experiences

It would be foolish to say that, by the use of the draft gauge, or the gas analyzer, or both, all burner troubles can be cured; however, I venture to say that unsatisfactory operation can be remedied in more than half of the cases through intelligent use of these two instruments.

There is, of course, a difference in operating characteristics of various types and makes of burners, but almost any unit made by a reputable manufacturer is capable of providing oil-heat comfort if it is so installed as to operate under near-ideal conditions. The installation man who installs even the highest grade of burner without first determining what the physical conditions are is simply courting trouble.

Here is the case of a dealer who figured that his burner was so "perfect" that he didn't need to bother about other things. For several months following installation the purchaser kicked about his fuel bills, and finally became so insistent that the dealer was forced to do something to keep from getting an order to remove the burner. He didn't know what a draft gauge looked like, and he didn't have one. However, he asked a friend who was not in the burner business, but who was a trained engineer, to help him. The friend borrowed a draft gauge and a gas analyzer and they started to locate the trouble. A hole was made in the smoke pipe and the draft-gauge tube inserted. With a jump, the oil in the gauge was sucked beyond the limit of the inclined tube, .05-in., and into the rubber tubing. There was little use in going further until this condition was corrected. The burner might as well have been set on a Kansas prairie during a cyclone. Two hours, and a draft regulator had been installed. This was so set that there was 0.03-in. draft in the combustion chamber, the burner was regulated (mainly by cutting down the oil supply) to a point where a satisfactory CO_2 was obtained—9.6% was the best that could be held without fluctuation—and the installation was left after a check of the oil in the fuel tank had been made.

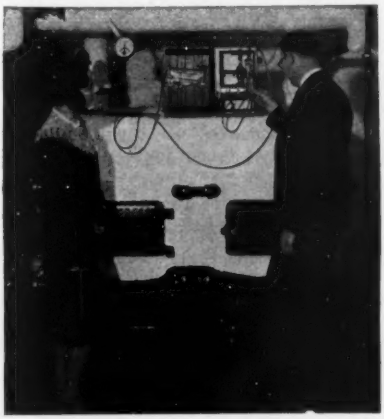
Complaints Stop

A week went by without complaint, and then the two experimenters went back and checked the oil consumption. The burner was behaving beautifully, and the oil consumption had dropped more than one-third. The owner found his fuel cost reduced to less than it had been with solid fuel and became one of the best boosters in the community, advising the dealer that his basement always was open when he wanted to show the installation to a prospective customer.

One of the best-known boiler designers in the country bought a rotary burner that turned out to be very annoying because of combustion-chamber noise. He began a study of operating conditions, with a draft gauge. He found that the burner was noisy when the combustion-chamber draft was around 0.03 in., but that the noise gradually died down as the draft was increased. When he reached 0.08 in. the combustion was as quiet as a drifting canoe, or cloud, or whatever drifts noiselessly. So he set the draft regulator to maintain this comparatively high draft in the combustion chamber, and they lived happily ever after.

Here's a curious yarn of a condition that probably has confronted every burner man who has put in twenty or more burners. This job was in a new home where the basement had been designed for a recreation room, and the burner had been set off in a little closet by itself. The installation man, using draft gauge and analyzer, had done a good job, leaving the burner showing 12.4 CO_2. However, complaints began to come in that the burner smoked and otherwise behaved badly. The dealer wisely sent, as trouble shooter, the man who had set the burner. When he entered the boiler room he first saw that the window, which he had left propped open, had been closed. No wonder that the burner smoked. Where was it to get combustion air?

So much, so good; the trouble had been found and remedied. But, two weeks later, another complaint. The same man went back, found the window closed, and a new maid in the kitchen to whom the window story had not been told. He took the window off its hinges and here the story ends. A burner *must* have air for combustion. If there is any doubt about the air supply, in a case like this, insert the draft-gauge pipe in the keyhole, pack a little putty around the tube and, if there is an insufficient supply of air, it will show by the gauge indicating a *negative* (below-atmospheric) pressure condition.



USING PORTABLE TEST SET FOR ADJUSTING OIL BURNER.

Watch for Leaks

The owner of a beautiful old-fashioned home bought a burner. When it had been installed it was found that a clean flame could not be produced. It was so "lazy" as to be indolent. The draft gauge showed only 0.05-in. chimney draft. In the combustion chamber it not only showed zero but, every little while, a positive pressure. Looking for the cause, the installation man found that the flue from an unused gas water-heater led to the boiler flue. This was disconnected and the opening sealed. The combustion-chamber draft immediately rose to almost 0.05 in., it was easy to get a CO_2 reading of 10.4%, and the draft regulator was set to maintain these conditions. Everybody happy.

* * *

Jack Cusick,
Pennsylvania.

"Enclosed is my check for renewal. During my five years of servicing refrigeration equipment I find the SERVICE ENGINEER the best I've ever subscribed for."

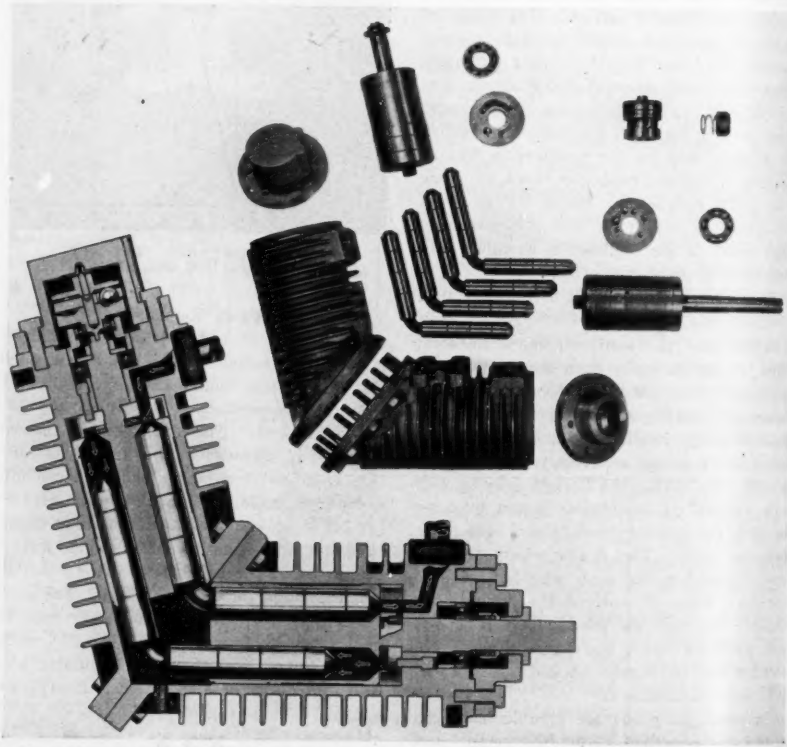
NEW MECHANICAL DEVICES
Service Tools and Special Equipment

Under this heading there will be published illustrated descriptions of new or improved service tools and equipment for the Service Engineer.

NEW COMPRESSOR DESIGN

DESIGNERS of a new compressor used to liquefy the gases used in refrigeration and particularly air conditioning apparatus invoked an entirely new mechanical principle and thereby omitted piston rings, piston-pins, crankshafts, connecting rods, gears, cams and valves from an 8-cylinder compressor.

The compression cylinders are bored in cylindrical blocks of metal—four cylinders



Above—Dissembled Parts of New Compressor. Left of photo shows casing in which cylinders revolve in pressure oil bath. Next above is shown the eight pistons and to each side are master cylinders each bored to receive four pistons. The circular discs are the ports which replace ordinary valve mechanism. Master cylinder at right is direct-connected to motor causing pistons to work backward and forward in both cylinders with screw-like motion.

Below—Cross section of new compressor designed without piston rings, piston pins, connecting rods, crankshafts, gears, stuffing boxes or valves. Diagram shows at lower left where power is applied causing cylinder to rotate. Power is transmitted to second master cylinder through action of pistons causing it to rotate. Extreme upper part of diagram shows pressure equalizer.

being bored to each block. In appearance a cylinder block bears a general resemblance to the cartridge chamber of an ordinary revolver. The pistons are forged in pairs as shown in the illustration. The pistons are inserted in cylinders, the rotation of a cylindrical block causes the pistons of both blocks to work back and forth compressing the gas in them. Compression cylinders and pistons rotate immersed in oil. Valves are not used, discharge ports in the plates at each end of the cylinder being located in such a manner that as the blocks rotate, they pass across the intake and the outlet ports at the proper time in each cycle. This allows pistons to operate within .005 in. clearance of cylinder heads, giving greatest volumetric efficiency.

This new design which is now in the production stage reduces the weight of compressors by forty-five per cent and space necessary for installation by a like percentage. Vibrations and consequent noise is reduced to practically nil. Other claims made for the new design, apart from those already mentioned are less power required and less wear due to the small number of parts and due to the fact that pistons travel in a screw-like motion in the cylinder bore.

ALCO NAMES DISTRIBUTORS

ALCO VALVE CO., INC., St. Louis, Missouri, manufacturers of automatic refrigeration control valves, announce the appointment of two new distributors. Himelblau-Byfield and Company, 228 North La Salle St., Chicago, Illinois, will handle the distribution for northern Illinois, and northern Indiana. J. M. Oberc, Inc., 1203 Stanley Avenue, Detroit, Michigan, will handle the distribution for the Detroit area.

PARTS DISTRIBUTOR

THE Carl John Stein Company, Chicago, distributors of refrigeration supplies and parts, is one of the oldest established companies in this particular branch of the business, having been established in 1890.

A rather interesting side-light connected with the history of the company is an old clock, made by Emil Geist, St. Paul, and which was presented to Mr. Carl John Stein in 1884, some six years prior to the incorporation of his company, and has run continuously since that time up to the present date. The clock is an excellent time-keeper and is valued as an heirloom.

The late Mr. Carl John Stein died four years ago, and the personnel of the present organization is as follows: L. V. Russell, President; Harry Drownes, Secretary; J. E. Hannan, Treasurer; Thomas Nolan, Vice President in charge of plumbing and steamfitting.

Air Conditioning

The company expects to take an active part in air conditioning installations, and will also issue, in the near future, a catalog on refrigeration supplies and parts.

They moved to their present location at 122 W. Illinois Street, September 1, and two floors 40 x 100 feet are devoted to supplying the requirements of the refrigeration service man. In addition, they carry an extensive line of repossessed Copeland and Majestic refrigerators of all models, which have been secured by the Carl John Stein Company as authorized agents for the largest finance corporation in Chicago. Service men interested in the resale of repossessed refrigerators will find a large and varied stock available.

Crawford E. Law,
New York.

Just having sent my renewal check for the REFRIGERATION SERVICE ENGINEER, would appreciate having the charts. Also would say it's a great magazine for the service man.

Fred Baker,
Kansas.

Enclosed find check for $2.00 for subscription to the SERVICE ENGINEER. Also send me the complaint charts. I think the SERVICE ENGINEER is the best that I have read and I have taken it since the first issue.

Charles V. Laynor,
Maryland.

Enclosed find money order for $2.00 for my renewal to the REFRIGERATION SERVICE ENGINEER. Also send me the 15 service charts. I enjoy reading your publication and I have secured valuable information from its contents.

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 2 October, 1934 No. 10

RATES OF SUBSCRIPTION
In Advance, Postage Paid
UNITED STATES - - - - - - - - - $2.00 a year
ALL OTHER COUNTRIES - - - - $3.00 a year
Single copies, 25 cents

Advertising rates on application. Make remittances by postoffice or express money orders, international money orders, checks or drafts on Chicago or New York, payable to Nickerson & Collins Co., Publishers.

NICKERSON & COLLINS CO., *Publishers*
General Office.....433 N. Waller Ave., Chicago
Telephone Austin 1303, 1304 and 1305
Eastern Office.....149 Broadway, New York City
Telephone Barclay 7-8275

Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

KEEP INFORMED

MECHANICAL refrigeration is making rapid progress. One of the most essential duties of the successful service man today is to keep abreast of the advancements which are being made in the design of the units themselves, as well as the accessories which comprise the complete installation. In a comparatively short space of time, the public has recognized that mechanical refrigeration has been taken out of the luxury class, and is considered a most essential necessity in the preservation of food stuffs, and for the control of temperatures for personal comfort.

Too much stress cannot be placed on the fact that the qualified service man today requires not only some theoretical knowledge of refrigeration, but also requires a good background of practical knowledge, which must be acquired by training and the service man must recognize that his training is never completed.

Today, the public recognizes that performance and results are the measuring stick of refrigeration. The service engineer cannot acquire too much knowledge for the successful operation of his business, and as a consequence, should exhaust every avenue of information that may add to his knowledge of refrigeration if he expects to make any advancement in his chosen profession.

While a practical knowledge of refrigeration is essential, service men possess many other qualities which have been treated in these pages, and which have been impressed upon him by training in factory schools or otherwise. He requires a good personality, neat personal appearance, mechanical skill, some knowledge of electricity.

Irrespective of his profession (and refrigeration servicing certainly can be considered a profession) personality is an important asset in the successful conduct of any business, whether he is operating his own institution or as an employee. Personal appearance is probably one of the best ways to judge a man's workmanship, and incidentally, a service man is called upon many times to service equipment in surroundings where it is imperative that he should be extremely careful not to damage expensive decorations, and furnishings. The service man must realize that in shooting a service call, he is answering a call from a householder whose refrigeration service is not rendering efficient service and oftentimes, the owner may feel that this is just another expense. Naturally, they rather reluctantly call the service organization, and usually the call is only after the unit has suffered a complete breakdown. Procrastination, of course, is human nature. The approach of the service man on such a call is going to mean considerable, as regards future business. The handling of such a call, and the service man's attitude is going to mean the difference between a satisfied customer, who will make an invaluable advertisement, or just another service call.

There is another important point that the independent service operator should not overlook. There is naturally some dissatisfaction on the customer's part when her refrigerating equipment is not giving the best service. Much can be accomplished by the service man in selling the customer on the equipment which she has and placing it in satisfactory operating condition. In other words, it pays dividends to keep the customer happy with the equipment she has rather than to discredit the machine.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

MEETINGS OF CHAPTERS

Detroit Chapter No. 1

Meeting of August 24

Mr. Clark conferred with the special committee which was recently appointed to consult with city officials with the view to amending the present ordinance covering refrigeration, and refrigerating machine installations, to license refrigeration service engineers, and not await the passage of the complete code, although the proposed code covers licensing of service engineers.

Mr. Clark reported that the committee, headed by himself, contacted the Department of Buildings and Safety Engineering, and was advised to let this amendment ride along, and the possibilities of passing a complete new code were better than getting it piece-meal. We will be guided by these instructions, and will continue to keep in touch with the Department of Buildings and Safety Engineering with a view to having an opportunity to be heard when the general proposed code is placed before the Common Council.

It was suggested that we avail ourselves of permanent meeting quarters, which would be available for the society for its various activities. Messrs. Hughes, O'Kane, and Burns were delegated to make an investigation of available quarters and to report on same to the meeting September 5th.

A business committee was appointed by the President, consisting of Messrs. Oberc, Abel, and Murphy. This committee is to meet and determine ways and means for meeting obligations which will be incurred the coming season. Also to devise ways and means to obtain appropriations from manufacturers of parts for advertising space to offset any expense which will accrue during the coming year. Further, the committee was to prepare a budget for the coming year.

It has been suggested that we finally make a drive for members, with the view of determining just who will join the society, in view of so many having expressed their intention to join up, and then having failed to continue or participate in the activities of the society. This subject is to be brought up for further discussion at the meeting September 5th.

The following officers have been elected for the coming season: Mr. Downs, President; Mr. Oberc, Recording Secretary; Mr. Beguhn, Secretary and Treasurer; Messrs. Abel and Mercer, Vice Presidents; and Mr. Clark, Chairman of Educational Committee. Other committees are to be appointed at a later date.

DETROIT CHAPTER RECEIVES ITS CHARTER

ONE of the important events in the history of Detroit Chapter was the formal presentation of its Charter on Monday evening, October 1. Over forty members were in attendance on this occasion, and Mr. O. Evans, as Chairman of entertainment committee, made arrangements for the charter meeting.

A most delightful banquet was enjoyed by all, and Mr. Evans in acting as the Chairman for this evening, introduced Detroit Chapter's President, Mr. J. H. Downs, who in his well chosen remarks, pointed now that Detroit Chapter was past its formative period, and had received its Charter from the National Society, it should make its plans and preparations for active work towards the future progress, which has been planned. Mr. Downs in turn introduced the National Secretary, Mr. H. T. McDermott, who addressed the members and guests, and formally presented the Charter to Detroit Chapter, which was accepted by President Downs.

After the formalities of the meeting were over, Detroit Chapter called upon several of its very talented members, who entertained in their own novel way. Mr. O. Evans and Mr. J. E. Perry combined to put on a show of legerdemain. Mr. John Robertson responded with several solos of some good old Scotch songs. The entertainment continued until the wee sma' hours.

CYLINDER SIZES TO MEET EVERY SERVICE NEED

Ansul Sulphur Dioxide

Available in 5, 10, 25, 70, 100 and 150 lb. cylinders, ton drums and tank cars. Every container analyzed to assure highest quality.

Ansul Methyl Chloride

Available in 3, 6, 15, 40, 60, 90 and 130 lb. cylinders. Low moisture and acid content guaranteed by analysis of every container.

ANSUL CHEMICAL CO.
MARINETTE - WISCONSIN

DU PONT

Artic
REG. U. S. PAT. OFF.
(DU PONT METHYL CHLORIDE)

Strict production control and analytical tests on ARTIC before shipping assure you of receiving a product *always* low in moisture and acidity, high in purity.

Adequate stocks of ARTIC are carried by distributors strategically located throughout the country, assuring prompt filling of orders. An ARTIC distributor is located near you.

Our experience of many years in manufacturing and handling ARTIC is summarized in a booklet for service men containing information on handling, servicing, testing for leaks, and other items of interest. Send for your free copy.

R&H Chemicals
THE R. & H. CHEMICALS DEPT.
E. I. DU PONT DE NEMOURS & COMPANY, INC.
Wilmington, Delaware
District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

Herkimer Institute

"Makers of All-Make Service Men"

1819 Broadway New York City

"A Practical Trade School"

New models and new refrigerants do not up-set service departments manned by "Herkimer trained" service mechanics. Competent men available for all localities. Dealers, Service Managers, Manufacturers, when in need of reliable service men—

Write, phone or wire—
no obligations.

Karlberg Replacement Seal for Servel Compressors

A new improved complete bearing plate and seal, replacing the seal now on the standard Servel compressor, particularly the old graphite type seal.

Write for prices and complete information.

TRICO COMPRESSOR SERVICE
42 N. Paulina St., Chicago

WHOLESALE
Refrigeration Supplies

Sulphur and Methyl	20c and 60c
Carbon Tetrachloride, per gal.	$1.60
All White Oil, per gal.	1.60
Semi-White Oil, per gal.	.90
Automatic Pressure Water Valves	6.00
Penn Cold Controls	3.95
Penn Low-side Controls	6.00
Thermo. Exp. Valves	7.50
Automatic Exp. Valves	$3.50 & 4.50

SPECIAL WHILE THEY LAST

56—Model 500 & 700 Majestic Refrigerators
2—Model X Copeland 1 HP Compressors
1—Model W.I.M. Zerozone 2HP Compressor
4—Type C-108 Larkin Coils

Above units repossessed by Finance Co. (Write or Wire for Special Prices.)

75—Ranco Cold Controls built for Stewart Warner, without face plate at $2.25 each

Also complete stock of Imperial Brass Flare and Sweat Fittings, Valves, Tools and Gauges, Copper Tubing, Motor Brushes and Bearings, Gates Belts. All at lowest market prices, f.o.b. Chicago.

CARL JOHN STEIN COMPANY
Est. 1890
122 West Illinois St., Chicago

MOST SERVICE ENGINEERS *know the merit of* ESOTOO *...everyone* SHOULD

Save money by using the sulphur dioxide that's always dry; purer than the water you drink; quickly available from conveniently-located distributing points . . .

EXTRA DRY ESOTOO
(Liquid Sulphur Dioxide)

and that other standby of the Refrigeration Service Engineer:

V-METH-L
(Virginia Methyl Chloride)

Consult our Service Department on any refrigeration problem; and write to-day for folders describing both these refrigerants.

VIRGINIA SMELTING Co.
WEST NORFOLK, VA.
76 BEAVER ST., N.Y. 131 STATE ST., BOSTON

Service Men

SELL PINCHOFF PROTECTORS TO YOUR CUSTOMERS

Thousands now in use.

A device that can be quickly installed over new or old pinchoffs by merely tightening two bolts. It will prevent liquid line breakage from vibration, bending, or careless handling. Cadmium plated. List price 15c. Ask your local supply house, or mail card for sample and discounts.

UNITED MFG. CO.
8878 W. Pico Blvd., Los Angeles, Calif.

SUPPLIES—PARTS—COILS—CHEMICALS—MATERIALS—UNITS

REFRIGERATION SPECIALTIES

"With Estimating Service for Service Engineers"

SERVICEMEN SUPPLY CO.
1819 Broadway, NEW YORK CITY
WRITE FOR NEW PRICE LIST

A Convenient Binder

for the Educational Material of the Service Engineers' Society

EVERY member of the Society should have one of these binders, as it provides a convenient method of using the educational material sent out by the Society, and also published in THE REFRIGERATION SERVICE ENGINEER.

In this and past issues of THE REFRIGERATION SERVICE ENGINEER are published valuable charts — Complaint Charts and Trouble Chart. Other charts will be published in succeeding issues. Provision is made so that these charts can be cut out of this issue and filed conveniently in the new binder. You should have a binder immediately, so that the charts appearing in this issue will provide a start for your handy reference book. It is attractively stamped on the front cover with the Society's name.

Size 4¼ in. x 7½ in. Holds Standard 3¾ in. x 6¾ in. sheet.

This flexible leather, six-ring binder is designed so that it can be conveniently carried in the pocket and used on the job every day. The educational material sent to each member of the Society will be designed so as to fit this convenient binder, also tables, charts and other valuable data published in THE REFRIGERATION SERVICE ENGINEER. A supply of ruled memorandum paper for making notes and sketches is furnished. The educational material published in THE REFRIGERATION SERVICE ENGINEER and that sent out by the Society will provide a valuable reference book that will be an indispensable help in solving every day servicing problems.

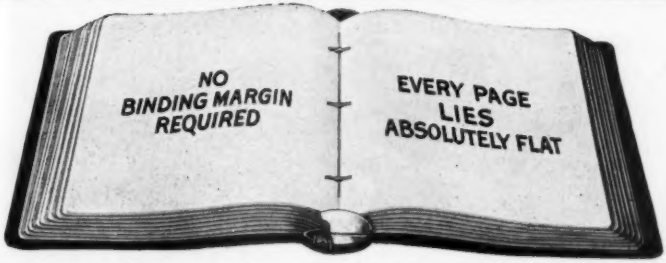
SEND REMITTANCE OF $1.00 TO THE

REFRIGERATION SERVICE ENGINEERS' SOCIETY

433 North Waller Avenue **CHICAGO, ILL.**

BIND—your copies of
THE REFRIGERATION SERVICE ENGINEER
for Future Reference

ALL COPIES ARE PUNCHED TO FIT THIS BINDER



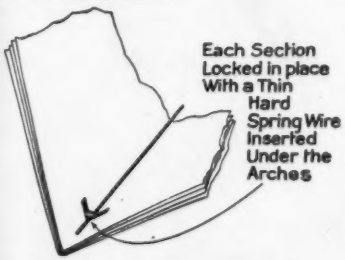
Every issue of this magazine will have valuable information which you will want to retain for future reference.

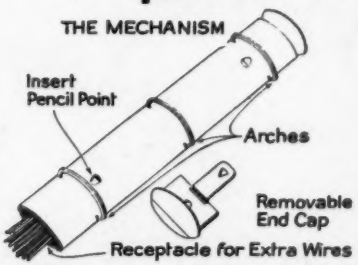
Here is a handy, substantial binder that permits you to add each copy readily as it is received. The binder is so constructed that regardless of the number of issues, every page lies flat and is easily read.

Holds twelve issues—an entire year's supply. No hunting around for lost or missing issues. The entire year's edition is always handy.

The name of the magazine is attractively stamped on the front cover in gold.

Only $1.00 postpaid





It's simple — here is how it works

Each issue is locked in place with spring wire. It takes only an instant to add an issue. Reserve supply of extra wires for future issues is kept in the back-bone of the binder. File your copies promptly as received.

Send Your Remittance of $1.00 to

THE REFRIGERATION SERVICE ENGINEER

433 NORTH WALLER AVE. CHICAGO, ILL.

This BOOK

Tells the Complete Sto of Refrigeration Contr

Vol. 2
No. 11

The
THREE
R's
OF
REFRIGERATION
CONTROL

THIS new book, The Three R's of Refrige-ration Control, has been especially pre-pared for Refrigeration engineers, dealers, salesmen and service and installation men. It explains the requisites and functions of the various refrigeration and cooling controls, and tells how these modern controls are built to stand up under overloads and con-ditions of damp and corrosive atmospheres that are peculiar to refrigeration. This valu-able book is yours for the asking. The coupon below will bring it to you.

Air Conditioning Controls

The many applications and exacting requirements of air conditioning demand perfect control. There is a Minne-apolis-Honeywell Control System for every air condi-tioning or cooling need. Each individual control is designed to accomplish its particular function with char-acteristic Minneapolis-Honeywell accuracy and efficiency and to operate in perfect harmony with other controls comprising the system . . . For complete satisfaction in meeting any desired air conditioning requirement, recom-mend and install Minneapolis-Honeywell controls . .

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2934 Fourth Avenue South, Minneapolis, Minnesota
Please send me, without cost or obligation, a copy of your new book, The Three R's of Refrigeration Control.

NAME _____

Company _____

Address _____

City _____ State _____

MINNEAPOLIS
HONEYWELL

Quality Controls Cost Less Than